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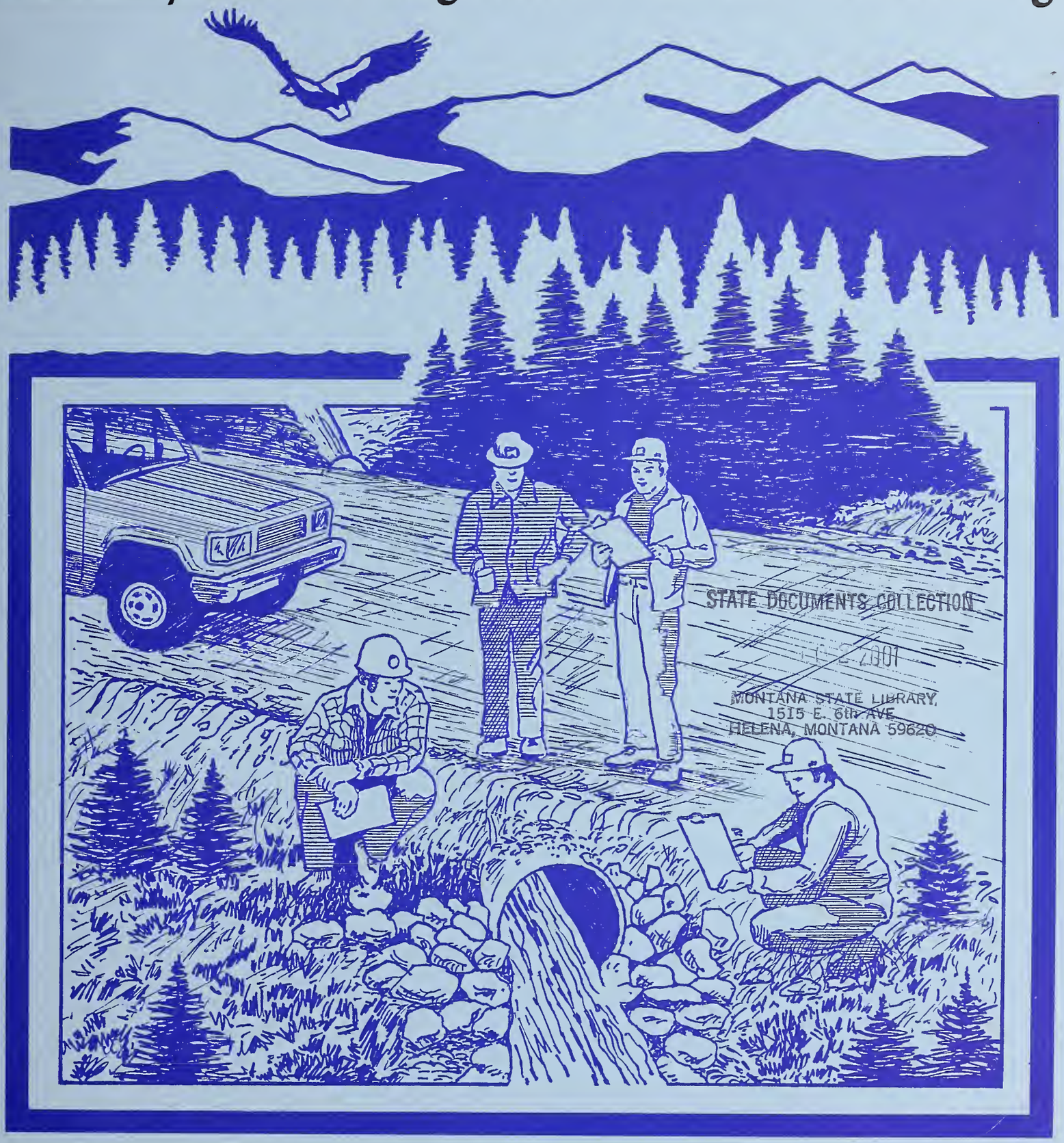

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FORESTRY BEST MANAGEMENT PRACTICES MONITORING

THE 2000 FORESTRY BMP AUDITS REPORT

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
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In 2000 the Service Forestry Bureau, Forestry Division of the Montana Department of Natural Resources and Conservation once more undertook the task of completing the Forestry Best Management Practices (BMP) audits. The Division graciously acknowledges the many people who gave their time and energy toward the audit effort. Special thanks go to the BMP Technical Working Group members who contributed to the task of reviewing the issues that arose from the 2000 audits as well as overseeing the entire process. A huge thank you to the audit team members who traveled extensively, worked long days in the field, and made many difficult decisions in a professional manner. Thanks also go to the Environmental Quality Council and Governor's office, to all who supplied information to select the sites, and to those who gave access to private lands. The Bureau would like to thank George Mathieus, Gary Frank, and Norm Fortunate. Their experience from previous audits was invaluable. Special thanks goes to Kate Kronen for creating and editing portions of this report. Thanks also go to Deb Harrison and Mira Bruner for their assistance with the details of this process.

EXECUTIVE SUMMARY

The Forestry Best Management Practice (BMP) audit process is used to evaluate whether BMPs are being applied and if they are effectively limiting non-point source pollution. The Governor has requested the Montana Department of Natural Resources and Conservation (DNRC), Forestry Division to evaluate forest practices for BMP implementation and report the findings to the EQC. This report summarizes the findings of Montana's 2000 forestry BMP audits, and complements similar study reports completed in 1990, 1992, 1994, 1996 and 1998.

Four interdisciplinary teams conducted the audits. Each team was composed of a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist, and a non-industrial private forest (NIPF) landowner or logging professional. DNRC used established site selection criteria to choose 42 new timber harvest sites harvested since 1998. The selection criteria limited the sample to those sites most sensitive to the practices that affect water quality. The audit teams evaluated a maximum of 46 BMPs at each site, rating application and effectiveness for each BMP on a 5-point scale.

The audit teams evaluated 42 sites for **BMP application.** Audit results showed that across all ownerships, BMPs were properly applied 96% of the time. Although many harvest sites had at least one instance where a BMP was inadequately applied, the majority of these departures were minor and did not cause erosion or deliver material to a stream. Ten percent of the sites had one or more BMP departures which resulted in some erosion or deposition of material to a stream. The application of eight high risk BMPs was evaluated separately because they are among those most important for protecting soil and water resources. Ninety-two percent of these high risk BMPs were properly applied.

The audit teams also evaluated **BMP effectiveness**. Audit results showed that across all ownerships, BMPs were effective in protecting soil and water resources 98% of the time. Slightly less than half of the sites had some minor departures in BMP effectiveness. Minor departures in effectiveness produce minor impacts to soil and water resources; eroded material reaches draws but not streams. Twenty-one percent of the sites had major departures in BMP effectiveness. Ninety-three percent of the eight high risk BMPs evaluated were rated as providing adequate protection to soil and water resources.

The greatest frequency of departures from BMPs, and the most impacts, were associated with road maintenance and drainage. The text includes a list of problematic BMPs on page 26.

The audit teams also evaluated application and implementation of the Montana Streamside Management (SMZ) Law. There were 17 SMZ rules departures noted during all the audits. All but two of these were minor and produced no discernible impacts to soil and water resources.

Summary of BMP and SMZ Application and Effectiveness, by Ownership Group

Practice	DNRC	Federal	Industry	NIPF	Totals
BMP APPLICATION	97%	96%	98%	94%	96%
BMP EFFECTIVENESS	98%	97%	99%	95%	98%
SMZ APPLICATION	98%	92%	97%	96%	96%
SMZ EFFECTIVENESS	98%	100%	99%	100%	99%

Similar audits were conducted in 1990, 1992, 1994, 1996 and 1998 and can be compared to the 2000 results. The 2000 audits show continued improvement in the application and effectiveness of BMPs when compared with previous audits. These comparisons are summarized below:

Comparison of BMP Audit Results – 2000 with 1998, 1996, 1994, 1992 and 1990

Category	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	92%	84%	81%	79%	72%	53%
Number of sites with at least one major departure in BMP application.	4 of 42 (10%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Average number of departures in BMP application, per site.	1.4	2.0	3.0	3.9	5.6	9
Percentage of practices providing adequate protection.	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection.	93%	89%	86%	83%	77%	58%
Number of sites having at least one major/temporary or minor/prolonged impacts.	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)
Average number of impacts per site.	1.0	1.5	2.3	3	4.6	8

INTRODUCTION

The forest lands of Montana are also the headwaters for several major river basins and produce large quantities of high quality water. This water nurtures some of the West's best fisheries and is used for irrigation and livestock, as well as for domestic, recreational and industrial purposes. These same lands grow the timber resources that sustain the forest products industry, one of Montana's major industries. All products from Montana's 22.5 million acres of forest land contribute in an essential manner to Montana's economy and way of life.

Montana's water quality protection program for forestry involves a combination of regulatory and non-regulatory approaches. Since the 1970's, non-regulatory Forestry Best Management Practices have provided guidance as minimum water quality protection standards for forestry operations. In 1987 Congress amended the Clean Water Act and added Section 319 to address non-point sources of pollution. Section 319 directed all States to develop non-point source pollution plans to address non-point source pollution problems.

At this same time, concern over the impacts of forest management on Montana's watersheds prompted the 1987 Montana Legislature to pass House Joint Resolution 49. This resolution directed the Montana Environmental Quality Council (EQC) to study "how current forest management practices are affecting watersheds in Montana." (Zackheim, 1988) The EQC established a BMP technical committee that developed Montana's first statewide forestry BMPs in 1987. In 1989, after two years of work, an interdisciplinary working group released the revised Forestry Best Management Practices. Since that time, the BMP Work Group has overseen the biennial process. In the interim between the 1996 and 1998 audit cycles the BMP Work Group reviewed and revised the 1989 BMPs. The 1997 version of the Best Management Practices For Forestry In Montana were used in the 1998 and 2000 audits (See Appendix A for the complete 1997 BMPs).

Forestry BMP audits have been conducted previously in Montana. As part of HJR-49, audit teams conducted the first statewide assessment of forest practices for BMPs during the summer of 1988 (Zackheim, 1988). In 1989, the University of Montana, under the Flathead Basin Water Quality and Fisheries Cooperative, audited more sites for BMPs in the Flathead River drainage (Ehinger and Potts, 1990). The Montana Legislature directed DNRC to conduct further series of statewide BMP audits in 1990, 1992, 1994, 1996 and 1998 (Schultz, 1990 and 1992; Frank, 1994; Mathieus, 1996; Fortunate, et al., 1998).

Forestry BMPs, if properly applied, can limit non-point source pollution--the kind of diffuse pollution that forestry operations often produce, such as sediment from a road or timber harvest. The BMP audit process has been consistently used since 1990 to evaluate whether BMPs are being properly applied and if they are effectively limiting non-point source pollution.

Prior to 1989, forestry water quality was addressed through a voluntary approach as part of the State's 1988 non-point source assessment and management plan. In 1989 the Montana Legislature enacted the BMP Notification Law (76-13-101 MCA), which requires private landowners who plan to harvest timber to notify the state of their plans. Under this law, forestry BMP information is sent to landowners. Implementation of Forestry BMPs is administered within a non-regulatory framework.

Since October 1991 the Streamside Management Zone (SMZ) Law (77-5-301 307 MCA) has regulated forest practices along streams. This law prohibits certain forest practices along stream channels and directs suitable streamside management practices. The SMZ rules (36.11.301 - 310 ARM) became effective March 15, 1993 and were intended to help define and clarify the SMZ law. The 1992 BMP audits did not evaluate compliance with the SMZ law because most operations audited were completed prior to the effective date of the rules. Beginning in 1994, the audits were designed to provide preliminary information on the application and implementation of the SMZ law and rules, using a supplemental SMZ questionnaire.

In 1998 the format used to evaluate the SMZ law and rules was the same as the one used to evaluate the BMPs for application and effectiveness on a 5-point scale. DNRC's intent was to supply data that would be more easily summarized.

In 1999 the Governor requested the Montana Department of Natural Resources and Conservation (DNRC) Forestry Division to once again evaluate forest practices for BMP implementation and report to the EQC before the 2001 legislative session. This report summarizes the findings of Montana's 2000 forestry BMP audits.

The BMP audit process, which the EPA calls BMP implementation monitoring, is a widely-used means of evaluating forest practices. Implementation monitoring is a surrogate for water quality monitoring, a more quantitative approach. Water quality monitoring is a long-term and expensive endeavor. Water quality varies naturally due to variable geology, land forms, soils, and climatic events. Due to this variability, investigators have to collect large numbers of samples over a long period of time to accurately characterize water quality.

In Montana investigators use qualitative implementation audits to find out if BMPs are being applied and whether they are controlling erosion. Since BMPs are recognized by state and federal legislation as a method to control non-point source pollution, it makes sense to check the application and effectiveness of BMPs as part of such a program. States are increasingly relying on qualitative surveys, using interdisciplinary teams to assess forest practices on-site, to monitor their silvicultural non-point source control programs (NCASI, 1988). California, Idaho, Oregon, Utah, Minnesota, Washington, South Carolina, Texas and Florida all use a similar qualitative approach to assess the control of non-point source pollution from forest practices.

Montana, through the DNRC, has appointed a technical work group that has overseen the BMP process since its inception and provides recommendations to DNRC. The work group members represent a broad range of interests in forestry in Montana. Several members also serve on the audit teams and many have been involved with the program since 1988.

METHODS

Objectives

BMP audits have been conducted every two years beginning in 1990; 2000 represents the sixth cycle. The 2000 audits were conducted with similar objectives and criteria as the previous audits in order to produce comparable results.

In 2000, the objectives of the BMP field audits were to:

1. Determine if BMPs are being applied on timber harvest operations.
2. Evaluate the general effectiveness of BMPs in protecting soil and water resources.
3. Provide information on the implementation of the SMZ law and rules and evaluate general effectiveness of SMZs in protecting water quality.
4. Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation.
5. Provide information on the need to revise, clarify, or strengthen BMPs.

The Study Area

The study area encompasses the entire state of Montana. The state is broken into four geographical regions, Northwest, West, Central, and Eastern (Appendix B). For administrative ease the regional breaks are located on county lines.

Sample Size And Distribution

Historically the target for the number of sites to be audited was set at 45. This number was based on the interaction between the number of days volunteer audit team members could be expected to commit to the audit process and the number of audits a team could reasonably conduct in one day. The maximum time commitment for audit team members was established at 10 days. This is for all audit-related activities, which includes calibration training, conducting the audits and a post-audit critique workshop. It was determined that a request exceeding 10 days would likely jeopardize the ability of individuals to participate, thus restricting the ability to field the desired number of fully-staffed teams. An audit team can be expected to complete one to two audits per day depending on the regional distribution of sites and the travel time between sites. Based on the above expectations and assumptions, the target number of audits was set at 45.

The targeted 45 audit sites are distributed across the state by geographical region (see Study Area above) and land ownership group. The audit process recognizes four ownership groups: State of Montana Trust Lands (DNRC), U.S. Forest Service/Bureau of Land Management lands (Federal), private industrial lands (Industry) and non-industrial private forest lands (NIPF). The basis for audit site distribution is the proportion of the total statewide harvest volume that is harvested within each region by each ownership group. Harvest volumes were obtained from the

1998 State of Montana Cut By County Report and USFS, BLM and DNRC annual harvest volume records.

Once volumes have been determined for each ownership group by region, the theoretical distribution of the 45 sites can be calculated. Such mathematical calculations will inevitably result in some integers, i.e., a mathematical result of 9.3 sites required. Additionally, it is possible that the calculated number of sites for an ownership group will be less than five, which is the minimum number of audit sites for an individual ownership group.* The calculated numbers are thus modified to a set of target numbers for site distribution. This target distribution is carried forward to the site selection process (see Site Selection below). From the site selection process and modifications made during the audits an actual number of audit sites results. Table 1 displays this evolution for the 2000 audits.

Table 1
Site Selections Calculated, Targeted and Actually Audited for Each Ownership by Region

Region	Industry			DNRC			Federal			NIPF		
	Calc	Target	Actual	Calc	Target	Actual	Calc	Target	Actual	Calc	Target	Actual
NW	9	8	8	0.6	1	2	6.2	5	4	2.6	3	1
West	9.7	9	9	0.7	2	2	3.2	3	2	4.3	3	1
Central	0.3	1	1	0.2	1	1	1.7	2	3	3.2	3	4
East	0	0	0	0.2	1	0	0.1	1	0	2.9	3	4
Total	19	18	18	1.7	5	5	11.2	11	9	13	12	10

TOTALS			
Region	Calc	Target	Actual
NW	18.4	17	15
West	17.9	17	14
Central	5.4	7	9
East	3.2	5	4
Total	44.9	46	42

A total of 42 sites were audited during the 2000 BMP audits (see Table 2 for historical site information). This number is slightly lower than the generally targeted goal of 45 sites. This is the result of several factors. One site selected during the screening process was eliminated after commencement of the audits. When field-checked, this site did not meet the minimum site selection criteria and could not be replaced in a timely manner. Other shortages resulted from regional availability of NIPF and Federal sites meeting the minimum selection criteria and the inability to obtain permission from some NIPF landowners to conduct an audit on their property.

The 42 sites are a representative sample of logging operations conducted in Montana since 1998 **that meet specific selection criteria** (see Site Selection below). The selection criteria restrict the sample to those sites where on the ground timber harvest and timber management-related activities have the highest opportunity to impact water quality.

Table 2
Historical Number of Sites Audited by Ownership Group

Ownership Group	2000	1998	1996	1994	1992	1990
DNRC	5	5	5	5	5	5
Federal	9	12	12	14	16	16
Industrial	18	18	14	14	16	16
NIPF	10	12	13	13	9	7
Total	42	47	44	46	46	44

See Appendix C for the list of audited sites.

Site Selection

In November of 1999 DNRC sent Industry, Federal and DNRC ownership group representatives a letter requesting potential BMP audit candidate sites. Each letter included a BMP Audit Site Information Form (see Appendix D) to be completed for each harvest operation that met the initial selection criteria (see below). Members of these ownership groups were very cooperative and provided essential information to DNRC. To obtain potential audit site information for NIPF ownership, DNRC searched its Hazard Reduction Agreements database and consulted with DNRC field service foresters for sites that met the initial criteria.

The criteria for selecting sites were similar to previous audits. The selection criteria limited actual audit sites to only those timber harvest sites most sensitive to the practices that affect water quality.

The initial criteria were:

- Timber harvest must have occurred during the years 1998, 1999, or 2000 prior to March 31.
- A portion of the sale needed to be located within 200 feet of a stream.
- The target size for harvest units to be included in the audit process was five acres or greater.
- The target timber harvest removal was 5 thousand board feet (5 MBF) per acre or greater for the west side units; for east side units the target was 3 MBF.

Sites that met the initial criteria were further stratified into seven prioritized groups depending on the forest management-related activities conducted at the site. The intent of this stratification was to maximize the number of BMPs evaluated. These groups were as follows:

- Priority 1 – Riparian harvest, new road construction or reconstruction, stream crossing culvert installation and slash disposal complete.
- Priority 2 – Stream within 200' of a harvest unit, new road construction or reconstruction, stream crossing culvert installation, slash disposal complete.
- Priority 3 – Stream within 200' of a harvest unit, new road construction or reconstruction, stream crossing culvert installation, slash disposal incomplete.
- Priority 4 – Stream within 200' of a harvest unit, new road construction or reconstruction, stream crossing without culvert installation, slash disposal complete.
- Priority 5 – Stream within 200' of a harvest unit, new road construction or reconstruction, stream crossing without culvert installation, slash disposal incomplete.
- Priority 6 – Stream within 200' of a harvest unit and slash disposal complete.
- Priority 7 – Stream within 200' of a harvest unit and slash disposal incomplete.

Road construction activities must have occurred during 1997 or later. Once all potential sites were received, DNRC assigned each site a priority number based on the information supplied on the BMP Audit Site Information Form (Appendix D). Sites were then stratified by Region and Ownership Group. Actual audit sites were then selected by Region and Ownership Group beginning with Priority 1 sites and progressing through other Priority levels as needed until the targeted distribution was met.

In 2000 all selected audit sites were initially rated as either Priority 1, 2, or 3 sites.

Additional considerations went into final site selection:

- An audit goal was to have two-thirds of the audits located on high hazard sites and one-third located on low to medium erosion hazard sites. High hazard sites are sites with either riparian harvest, high soil erosion potential, or both. Erosion hazard was determined using the erosion hazard matrix developed by the Montana Riparian Association (see Appendix E). It was believed that the prioritization process would produce this outcome. Table 3 shows the percentage of audited sites that, based on field evaluation, met the high hazard criteria.
- Logistics is also considered as a determinant of the sites selected. Sites of equal priority level could be exchanged to accommodate reasonable team travel.

Table 3
Percentage of Sites Meeting High Hazard Criteria

Ownership Group	Number of Sites	Number of High Risk Sites	Percentage of High Risk Sites	Number of Sites With Riparian Harvest
DNRC	5	4	80	0
Federal	9	5	56	3
Industry	18	14	78	14
NIPF	10	8	80	5
All Sites	42	31	74	22

An associated site selection issue is that of access to potential audit sites. BMP audits are voluntary, and thus permission to access a site must be granted by the landowner group or, in the case of NIPF lands, the individual landowner. The DNRC, Federal and Industry ownership groups have all agreed to unrestricted access to BMP audit sites, and access is not an issue. In the case of non-industrial private land, DNRC must obtain permission from each individual landowner prior to conducting an audit on their property. In order to accomplish this, DNRC made an initial contact by telephone to request permission to audit individual timber harvest sites. If access was granted, a follow-up letter was sent to each landowner explaining the purpose of the audit process as well as DNRC's policy toward enforcement actions.

The sample size and sites selected DO NOT represent a sample of all timber harvest operations in Montana-- ONLY those meeting site selection criteria. These selected sites are those located in proximity to streams and therefore have the greatest potential for non-point source pollution to occur.

The Audit Teams

Four audit teams were formed to conduct the 2000 audits--one for the northwestern, one for the western, one for the central, and one for the eastern parts of the state. These teams were composed of seven members--a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist, and a shared position of logging professional or representative of non-industrial private forest landowners (NIPF). A member of each audit team was assigned to lead the team. The team leader was responsible for providing general leadership and direction as well as filling out the official rating form and overseeing the logistics of the team. Team members were employees of federal and state agencies, private industry, conservation organizations, independent consultants, or volunteers.

Two training sessions were conducted prior to the actual audits: one for the Northwest and West teams and one for the Central and East teams. These sessions served as a refresher to those with previous experience and as a calibration to the new team members. All team members, including alternates, were strongly encouraged to attend one of these sessions. The goal was to have the audit teams establish a consistent method of rating that could carry through the rest of the audits. Team members and alternates met for several hours of classroom instruction on the BMP audit process and then evaluated a sample audit site in the field. The team members shared their

results with the other members and identified and discussed their differences and ways to be consistent. See Appendix F for a complete list of team members.

Photo #1. East and Central Teams Calibration Training

The Rating Form

The audit teams used a rating form similar to that of previous audits. The guide for rating application and effectiveness was the same as that used in the previous audits. The audit teams evaluated a maximum of 46 BMP practices and 10 SMZ practices at each site. The rating of application and effectiveness for each was done on a 5-point scale, as in the past. See Appendix G for a copy of the rating form.

The audit team rated the application of BMPs by first noting if the BMP was applicable to the site and, if so, whether it was applied to the correct technical standard, at the correct frequency, and in the proper locations. The audit teams used a flow chart or decision tree to help rate application and effectiveness and, again, to keep the rating consistent. See Appendix H.

Lack of adequate application or misapplication are departures from the BMPs. The rating guide for the application of BMPs is:

5 - Operation exceeds requirements of BMP.
4 - Operation meets requirements of BMP.
3 - Minor departure from intent of BMP.
2 - Major departure from intent of BMP.
1 - Gross neglect of BMP.

The following description of the rating guide is adapted from Ehinger & Potts, 1990. Ratings of 5 and 4 are self-explanatory. The 3 rating, minor departure, applies to departures of small

magnitude distributed over a localized area, or over a larger area where potential for impact is low. The 2 rating, major departure, applies to departures of large magnitude or to BMPs being repeatedly neglected. The 1 rating, gross neglect, applies where risks to soil and water resources were obvious, yet there was no evidence indicating that operators had applied BMPs to protect these resources.

The effectiveness rating addresses how well the application of the applied BMP worked. This rating answers questions concerning impacts; for example, "Has the application or misapplication of a particular forest practice increased the likelihood of, or actual occurrence of, sediment delivery to streams?" Lack of effectiveness results in impacts.

The rating guide for effectiveness was:

5 - Improved protection of soil and water resources over pre-project condition.
4 - Adequate protection of soil and water resources.
3 - Minor and temporary impacts on soil and water resources.
2 - Major and temporary, or minor and prolonged, impacts on soil and water resources.
1 - Major and prolonged impacts on soil and water resources.

The work group defined these terms prior to the 1990 audits to help the audit teams use them consistently:

Adequate--Small amounts of material eroded; material does not reach draws, channels, or floodplain.
Minor--Some material erodes and is delivered to draws but not to stream.
Major--Material erodes and is delivered to stream or annual floodplain.
Temporary--Impacts lasting one year or less; no more than one runoff season.
Prolonged--Impacts lasting more than one year.

Occasionally a BMP did not apply on a site. Some sites did not have stream crossings or new road construction; most sites did not have borrow pits; in several instances, slash disposal and site preparation had not been completed. In other cases, the audit team could not rate the BMP at the time of the audit--BMPs having to do with timing of operations during the harvest cannot be judged post-harvest. When these situations occurred, the team noted on the form that the practice did not apply and no rating was given. In 2000, 90 percent of the possible BMP practices and 99 percent of the SMZ practices were rated.

Audit Site Inspections

The teams conducted the audits from late June through early September of 2000. The field routine consisted of meeting at a central location in the morning of each audit day. Teams traveled to the audit site. When on location, the team leader provided maps and audit forms. Usually a representative of the landowner briefed the team by giving background information on the silvicultural prescription, time of operation, and associated practices. This is when the final decision was made on which roads and harvest unit would be audited. Team members walked the site, reviewing potential impact areas such as roads, streams, SMZs, skid trails and firelines. Teams typically spent about two hours inspecting each site.

Photo #2. Northwest Audit Team Evaluating Harvest Unit.

After finishing the inspection, the team gathered to discuss the rating while still on site. The team leader was charged with leading the discussion and recording the consensus rating for each item on the rating form. For ratings where the team could not reach a consensus, the team took a vote and recorded the rating with the most votes. The team leader noted dissenting opinions in the Comments section. Teams almost always reached a consensus. Many observers attended the audits and gave feedback when requested but were not allowed to participate in the rating or to lobby for a particular score.

Limitations of the Audit Methods (in part, adapted from Idaho DHW, 1989.)

In analyzing the audit results, readers need to consider the limitations of the techniques used in the audit. The audit technique consisted of a one-time field inspection and assessment. This approach documents erosion and sedimentation problems which occur in the first or second year after harvest. This is generally the critical period for erosion associated with timber harvests. Some practices conducted during harvest cannot easily be evaluated in post-harvest audits. The assessment was based on visual appraisals of practices and impacts to surface soils and streams. The results are a "snapshot in time" of the practices and subsequent impacts. They do not necessarily reflect future impacts. During the 1998 audits, sites previously audited in 1996 and 1994–i.e., four- to six-year-old sites–were examined for long-term impacts. This information can be found in the 1998 Forestry BMP Audit Report (Fortunate et.al.)

Sites were split among four teams. Although rating inconsistency between teams should not be overlooked, its effect is probably minor due to the interaction between teams and the continuity of experienced team members. DNRC attempts to monitor each team to help ensure consistency.

Also, auditors may rate several practices connected with one action. In some cases, one action may result in more than one rating. For example, if a skidder operates extensively in the Streamside Management Zone, the practice may rate poorly under both "Adequate SMZ Maintained" and "Equipment Operation Minimized in SMZ." Even given these limitations, the BMP audit process is an effective way to evaluate the implementation of BMPs. In addition, the audit process has helped promote BMPs and encourage landowners and operators to protect water quality on managed forests.

Photo #3. West Team Evaluates Road Obliteration and Recontouring

RESULTS

This section presents the results of the 2000 BMP field audits. Results will be in four parts: BMP Application, BMP Effectiveness, High Risk BMPs, and SMZ Results.

Results will be presented in three formats: summary data for BMP practices (Tables 4 and 7), summary data for audited sites (Tables 5 and 8), and a listing of the specific BMPs that incurred departures and impacts (Tables 6 and 9). For reference Appendix I presents a summary tabulation of ratings by individual BMP.

Photo #4. Central Audit Team Filling Out Rating Form

Application of BMPs

The application rating measures whether the BMP was applied, whether it was applied correctly, and whether it was applied in the proper locations. See "The Rating Form" section on page 10 for further explanation of the application rating. The audit teams evaluated a total of 1,734 practices to assess how landowners and operators applied BMPs. SMZ practices were rated separately. Tables 4, 5 and 6 present results relevant to BMP Application.

Table 4
Application of BMPs to All Rated Practices
by Ownership Group and Rating Category

Ownership Group	# Practices Rated	Percent (%) Practices Rated As			
		Meet or Exceed	Minor Departures	Major Departures	Gross Neglect
DNRC	223	97%	3%	<1%	0%
Federal	349	96%	4%	<1%	0%
Industrial	733	98%	2%	0%	0%
NIPF	429	94%	6%	<1%	0%
All Sites	1,734	96%	3%	<1%	0%

Practices were applied correctly 96 % of the time. In terms of departures (Table 6), of the 1,734 practices evaluated, 62 practices had departures, 57 ratings of 3 (minor departures) and 5 ratings of 2 (major departures). There were no ratings of 1 (gross neglect).

Table 5 details the percentage of **sites** with application departures and average number of departures per site. The table shows that 62% of the sites audited were producing at least minor departures at an average of 1.3 departures per site. Ten percent of all sites were producing major departures--an average of 0.12 per site. Twenty six percent of the sites had no departures.

Table 5
Audit Sites with Departures from BMP Application
and Average Number of Departures per Site

Ownership Group	Total # of Sites	Percentage of Sites w/out Impacts	Percentage (%) of Sites with Departures			# of Departures/Total # of Sites = Ave. #/Site		
		Adequate or Improved Protection	Minor	Major	Gross	Minor	Major	Gross
DNRC	5	0%	80%	20%	0%	1.2	.2	0.00
Federal	9	11%	78%	11%	0%	1.4	.11	0.00
Industrial	18	50%	50%	0%	0%	.78	0.00	0.00
NIPF	10	10%	80%	20%	0%	2.4	.30	0.00
All Sites	42	26%	62%	10%	0%	1.3	.12	0.00

In Table 5, each category of departures must be considered separately, since a site may have departures in more than one category.

Table 6 identifies the specific BMPs where departures occurred. The list is order from most to fewest departures.

Table 6
Individual BMP Practices* Where Application Departures Occurred and a Summary of the Ratings Given

SECTION	BMP SUBSECTION	BMP	2 Rating Departures	3 Rating Departures	Total Departures
III	C	1		12	12
V	B	1B	1	8	9
III	C	2		5	5
III	C	6	1	4	5
III	D	5		4	4
III	E	1		3	3
III	E	2	1	2	3
IV	C	8		3	3
III	C	4		2	2
III	E	3		2	2
V	C	2		2	2
V	C	3		2	2
V	C	4	1	1	2
III	D	2		1	1
III	D	3	1		1
III	D	6		1	1
III	D	8		1	1
III	E	6		1	1
III	E	8		1	1
IV	B	5		1	1
IV	C	5		1	1
TOTALS			5	57	62

* See Appendix A for a description of individual BMPs.

Photo #5. Central Team Evaluates Stream Crossing Culvert and Slash Filter Windrow

Effectiveness of BMPs

The effectiveness rating evaluates how well BMPs protected soil and water resources. See page 11 for further explanation of the effectiveness rating. The audit teams evaluated a total of 1,734 practices for effectiveness. Table 7 provides a summary of the effectiveness of all practices audited, by ownership group.

The effectiveness information in Table 7 should be used with thoughtful discretion. While simple percentage ratings may be relatively high for the category Adequate Protection (98%), less than adequate effectiveness of an individual BMP will result in impacts.

Adequate protection was provided 98% of the time. In terms of impacts (Table 9), of 1,734 practices evaluated, 42 practice departures had impacts, 30 ratings of 3 (minor temporary impacts) and 12 ratings of 2 (major temporary or minor prolonged impacts).

Table 7
Effectiveness of BMPs for All Rated Practices
by Ownership Group and Rating Category

Ownership Group	Number of Practices Rated	Percentage (%) Practices Rated As			
		Adequate Protection	Minor/Temp. Impacts	Major/Temp., Minor/ Prolonged	Major/ Prolonged
DNRC	223	98%	2%	<1%	0%
Federal	349	97%	1%	1%	0%
Industrial	733	99%	<1%	<1%	0%
NIPF	429	95%	4%	1%	0%
All Sites	1,734	98%	2%	<1%	0%

Table 8 lists the percentage of sites with impacts and average number of impacts per site. The table shows that 48% of the sites audited had at least minor/temporary impacts--an average of 0.71 per site. Twenty-one percent of all sites had major/temporary impacts--an average of 0.29 per site.

Table 8

Audit Sites with Impacts and Average Number of Impacts per Site

		Percentage (%) of Sites w/out Impacts	Percentage (%) of Sites With Impacts			# of Impacts/Total # of Sites = Ave. #/Site		
Ownership Group	Total # of Sites	Adequate or Improved Protection	Minor/ Temp.	Major/Temp., Minor/ Prolonged	Major/ Prolonged	Minor/ Temp.	Major/Temp. Minor/ Prolonged	Major/ Prolonged
DNRC	5	40%	60%	20%	0%	.80	.20	0.00
Federal	9	44%	33%	33%	0%	.56	.44	0.00
Industrial	18	61%	33%	6%	0%	.33	.06	0.00
NIPF	10	10%	80%	40%	0%	1.5	.60	0.00
All Sites	42	43%	48%	21%	0%	.71	.29	0.00

Table 9 identifies the specific BMPs where impacts occurred. The list is order from most to fewest departures.

Table 9

Individual BMP Practices* Where Effectiveness Impacts Occurred and a Summary of the Ratings Given

Section	BMP Subsection	BMP	2 Rating	3 Rating	Total Effects Impacts
III	C	1	1	8	9
III	C	6	2	4	6
V	B	1B	4	2	6
III	D	2		3	3
III	C	2		2	2
III	C	4		2	2
III	E	2	1	1	2
V	C	2	1	1	2
III	D	3	1		1
III	D	5		1	1
III	E	1	1		1
III	E	3		1	1
III	E	8		1	1
IV	B	5		1	1
IV	C	5		1	1
IV	C	8		1	1
V	C	3		1	1
V	C	4	1		1
TOTALS			**12**	**30**	**42**

*See Appendix A for a description of individual BMPs.

Photo #6. Northwest Team Reviews Audit Process With Landowner Representative

High Risk BMPs

Simple percentages alone will not give a clear picture of the application and effectiveness of Montana's BMPs. Even a low percentage of misapplied BMPs can still result in major impacts. Additionally, all practices evaluated can affect water quality, but their potential impacts vary greatly. For example, drainage from a skid trail half a mile from a stream will not have as direct an impact on water quality as providing adequate road surface drainage at a stream crossing. In an effort to gain insight regarding the practices with the higher potential to directly impact water quality, eight high risk BMPs have been identified and analyzed separately. They are among the most important for protecting Montana's watersheds. They include:

BMP Number	Practice Description
III.C.1	Provide adequate road surface drainage for all roads.
III.C.6	Route road drainage through adequate filtration zones before entering a stream.
III.D.2	Stabilize erodible soils (i.e., seeding, benching, mulching).
III.E.2	Maintain erosion control features (dips, ditches and culverts functional).
IV.A.5	Design and locate skid trails to avoid concentrating runoff.
IV.B.5	Adequate drainage for temporary roads, skid trails, fire lines.
IV.C.8	Limit water quality impacts of prescribed fire.
V.C.4	Prevent erosion of culvert and bridge fills (i.e., armor inlet and outlet).

The results for application and effectiveness of the eight high risk BMPs is presented in Tables 10 and 11. Figures 1 and 2 show a comparison between All BMPs and High Risk BMPs.

Table 10 shows the BMP application for the eight high risk BMPs that were evaluated separately. The percentage of practices with departures is higher for the high risk group (Table 10) than for all audited practices (Table 4), as shown in Figure 1.

Table 10

Application of High Risk BMPs
by Ownership Group and Rating Category

		Percent (%) Practices Rated As			
Ownership Group	# Practices Rated	Meet or Exceed	Minor Departures	Major Departures	Gross Neglect
DNRC	40	93%	5%	2%	0%
Federal	65	85%	14%	2%	0%
Industrial	137	97%	3%	0%	0%
NIPF	78	87%	12%	1%	0%
All Practices	320	92%	8%	<1%	0%

Table 11 shows the effectiveness of the eight high risk BMPs. The percent of practices providing adequate protection is lower for the high risk BMPs than for the total BMP results presented in Table 8, but greatly improved over previous audits. The percent of practices resulting in impacts are higher for the high risk BMPs than for practices in general (Figure 2).

Table 11

Effectiveness of High Risk BMPs
by Ownership Group and Rating Category

Ownership Group	Number of Practices Rated	Adequate Protection	Minor/Temp. Impacts	Major/Temp., Minor/ Prolonged	Major/ Prolonged
DNRC	40	90%	7%	2%	0%
Federal	64	91%	4%	5%	0%
Industrial	137	99%	1%	0%	0%
NIPF	78	86%	13%	1%	0%
All Practices	320	93%	5%	2%	0%

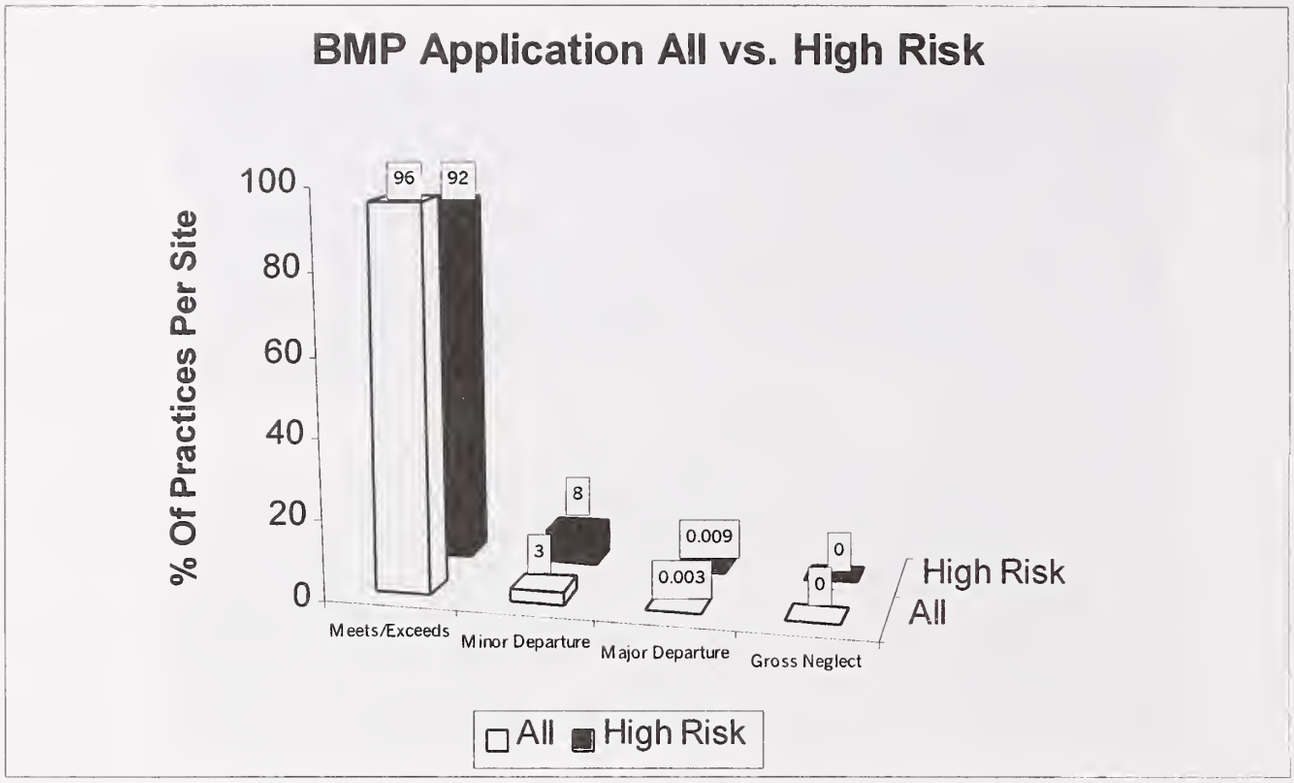

Figure 1

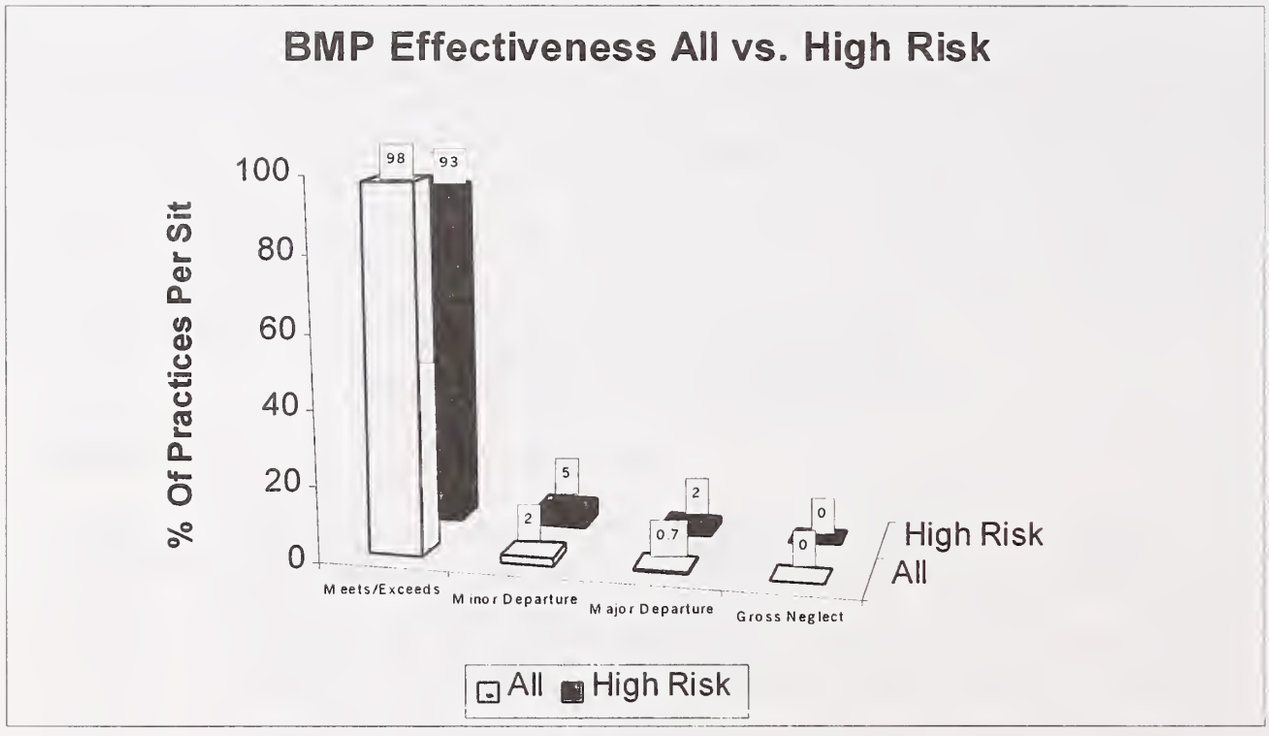

Figure 2

Streamside Management Zones

There is a somewhat different purpose in auditing SMZ rules compared to BMP practices. They both are designed to protect water quality. However, auditing SMZ law activities is a non-regulatory look at SMZ rules compliance, whereas BMPs are, by definition, non-regulatory.

The same SMZ rating form was used in 2000 as was used in the 1998 audits (Appendix G, p. 59). A total of ten practices were rated in 2000. The practices rated were all taken from the SMZ rules. The scoring was the same as the 46 BMP questions with a 5-point rating scale. **These ratings did not constitute an investigation or a DNRC enforcement action** nor were they used as a basis for future enforcement actions. Audit team members evaluated departures based on their best professional judgment.

Photo #7. Audit Team Measuring SMZ Width

The SMZ law and rules were applicable to all 42 sites. Harvest of trees within riparian areas (not necessarily the SMZ) occurred on 22 of the 42 sites (Table 3). Four pre-approved alternative practices, as allowed under the SMZ Rules, and three DNRC-approved, site-specific alternative practices were utilized on five of the sites evaluated.

A total of 17 SMZ departures were noted on 11 of the 42 sites evaluated. These numbers are down slightly from the 1998 audit results (Table 12). A total of 413 SMZ evaluations were made. SMZ rules were applied correctly 96% of the time. Of the 17 departures, 14 were minor and 3 were major.

Table 12
SMZ Departures by Ownership Group

Ownership Group	Number of Sites Evaluated		Number of Sites With Departures		Total Number of Departures	
	1998	2000	1998	2000	1998	2000
DNRC	5	5	1	1	2	1
Federal	11	9	3	4	3	7
Industrial	18	18	3	3	3	5
NIPF	12	10	5	3	7	4
All Sites	46	42	12	11	15	17

Consistent with previous audits, properly maintaining and marking the SMZ was the most common departure and occurred on six of the sites. Other practices with departures of greatest concern were equipment operation in the SMZ and sidecasting. See Table 13 for the summary and comparison of SMZ departures by practice.

Table 13

SMZ Departures by Practice

Practice	# Departures
Broadcast Burning in SMZ	0
Equipment Operation in SMZ	5
Clearcutting/Retention Tree Requirements	2
Sidecasting into Stream	2
Slash Deposited into Stream	0
SMZ Maintained/Properly Marked	6
Road Construction in SMZ	1
Exclusion of Road Fill in SMZ	1
TOTAL	17

Figure 3 provides information on the percentage of sites, for each ownership, upon which departures occurred.

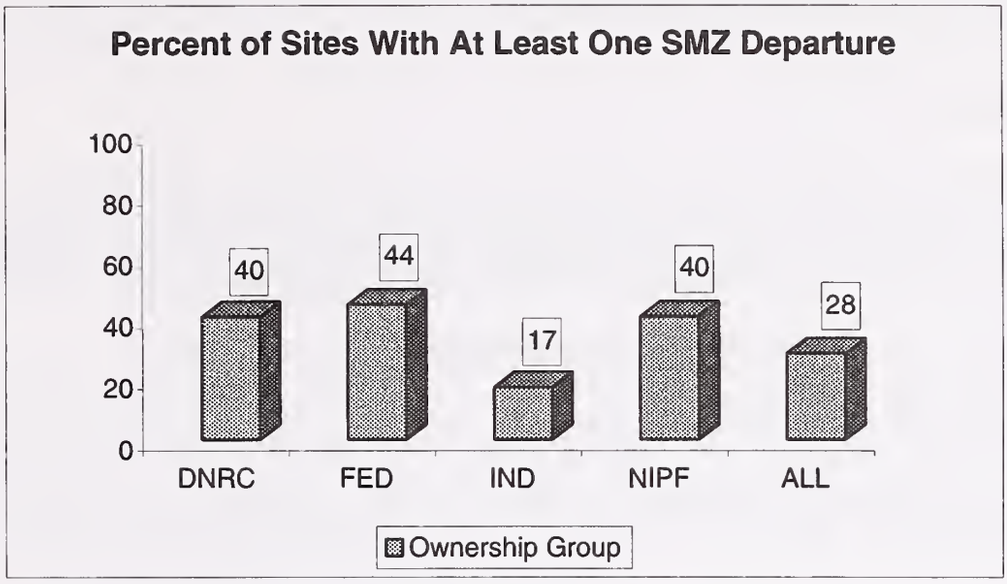

Figure 3

SMZ effectiveness was very high, over 99% for all ownerships combined. Of the 413 SMZ evaluations 410 provided adequate protection. Of the 3 impacts observed one was minor and two major.

SMZ Width

Although the BMP Audit form is not designed to provide highly specific results analysis regarding SMZ widths there is information that can be presented.

With regards to SMZs requiring a minimum width of 100 feet (percent slope greater than 35%) the maximum width recorded was 150 feet, the minimum 100 feet and the average 113 feet.

For SMZs requiring a minimum width of 50 feet (percent slope less than 35%) the maximum width recorded was 90 feet, the minimum was 39 feet and the average 62 feet.

Results show that 5 audit sites (12% of the total sites) received application departures for not maintaining the minimum SMZ width throughout the entire length of the SMZ evaluated. Of these 5 sites only one had an average width less than 50 feet. All other sites maintained the minimum through out most of the evaluated portion of the SMZ but had at least one measured location where the width was less than the minimum.

DISCUSSION

Table 4 indicates that 96% of the practices rated were properly applied according to BMP standards. These percentages represent an improvement over all previous audits (see Table 16). The high application compliance percentage demonstrates the strong commitment all ownership groups have for BMPs.

Table 8 indicates that:

- Forty-three percent (18 out of 42) of the audited sites had no impacts recorded.
- Forty-eight percent of the audited sites (20 out of 42) had minor/temporary impacts.
- Twenty-one percent (9 out of 42) had either major/temporary or minor/prolonged impacts.
- **There were no sites where major/prolonged impacts occurred**.

A site could be counted in more than one category.

As suggested in Table 10, 8% of the high risk BMPs were not properly applied, and this resulted in impacts.

The most frequent departures and impacts were associated with road drainage. The following list ranks rated BMPs by the sum of departures and impacts. So Practice III.C.1 is ranked #1 because it had more total departures and impacts than any other practice. An (--) indicates departures and impacts were not frequent enough to be in the top list for that year.

Practice #	BMP Description	2000	1998	1996	1994	1992	1990
III. C. 1 *	Provide adequate road surface drainage for all roads	1	1	1	1	3	1
V. B. 1b	Direct road drainage away from stream crossing site.	2	5	3	3	13	19
III. C. 6 *	Route road drainage through adequate filtration zones before entering a stream	3	2	7	2	2	3
III.C.2	Skew ditch relief culverts	4	8	10	--	--	--
III. D. 5	Cut and fill slopes at stable angle.	5	10	6	--	12	--
III. E. 2 *	Maintain erosion control features (dips, ditches and culverts functional).	6	3	5	5	--	10
III. C. 4	Provide energy dissipaters at drainage structure outlets where needed.	7	4	14	11	--	--
III. D. 2 *	Stabilize erodible soils (i.e., seeding, benching, mulching).	8	6	8	8	15	4
III.E.1	Grade road as necessary to maintain drainage	9	--	--	--	--	--
IV.C.8*	Limit water quality impact of prescribed fire	10	--	--	--	--	--
V. C. 2	Culverts conform to natural streambed and slope.	11	8	--	10	--	--

* Indicates "High Risk" BMPs.

The top three BMPs on the above list account for 45% of all departures and impacts. It can also be seen from this listing that the top three for 2000 also rank toward the top of the list over all audit years.

The practices listed above accounted for 79% of all departures and 83% of all impacts. The ten remaining BMPs where departures or impacts occurred had three or less departures plus impacts. One of the high risk BMPs, "Design and Locate Skid Trails to Avoid Concentrating Runoff," did not receive any downgrades. Of 46 practices rated, 25 had zero departures or impacts.

Combining application and effectiveness, the 2000 audits rated a total of 3,468 practices across all 42 audited sites. There were a combined a total of 104 ratings with a departure or impact. **A departure or an impact occurred on 3% of all practices rated.** See Appendix J for a ranked summary of all departures and impacts by BMP for the 2000 audits.

An interesting question concerns the effectiveness fate of an application departure. When a BMP received an application rating of 3 (minor departure from BMP), 42% of the time the corresponding effectiveness rating was 4 (adequate protection), 46% of the time the corresponding effectiveness rating was 3 (minor temporary impacts), and 12% of the time 2 (major temporary or minor prolonged impacts). In all cases when a BMP was rated a 2 for application, the effectiveness rating was 2.

Audit team members noted a range of water quality impacts not resulting directly from the audited timber sale. Both grazing and third-party road impacts were observed at several audit sites. Grazing was noted as being especially significant in impacting water quality. Teams noted that in at least one case grazing impacts in a stream channel created difficulties in rating the applicable BMPs. It was difficult to tell if the BMP was adequately applied because grazing impacts had removed the evidence indicating the level of original application. Third-party roads are roads not owned or directly controlled by the audited party. Several situations were noted where impacts were occurring because either roads were not adequately maintained by the road owner or roads were being used for another purpose, and that non-audit activity was causing impacts.

Results by Region

Tables 14 and 15 present general application and effectiveness results by region for all BMPs.

Table 14
BMP Application Results by Region

Region	Total Practices Audited	Percent of Practices with No Departures	Percent of Practices with Minor Departures	Percent of Practices with Major Departures
Northwest	636	98.3	1.4	0.3
West	599	96.5	3.5	0.0
Central	371	93.8	5.7	0.5
East	128	94.5	4.7	0.8

Table 15
BMP Effectiveness Results by Region

Region/ Percent of Practices	Total Practices Audited	Percent of Practices with No Impacts	Percent of Practices with Minor Impacts	Percent of Practices with Major Impacts
Northwest	636	98.6	0.8	0.6
West	599	98.1	1.7	0.2
Central	371	95.2	3.5	1.3
East	128	96.8	1.6	1.6

Because of the relatively small sample size, few strong conclusions can be drawn from this information. In general we can say that there is no great disparity in results between regions. There is no region of the state where implementation and effectiveness ratings indicate a specific need for education or auditing attention above the current level.

Results by Ownership Group

All ownerships scored 94% or higher for application of rated practices with a weighted average of 96% (Table 4). This is an outstanding achievement. Rankings for application of BMPs were as follows:

1. Industry
2. DNRC
3. Federal
4. NIPF

Across all ownerships the scores for effectiveness were 95% and above, with a weighted average of 98% (Table 7). In BMP effectiveness, the rankings were as follows:

1. Industry
2. DNRC
3. Federal
4. NIPF

Comparison with Previous Audits

The 2000 audits are directly comparable to the 1990, 1992, 1994, 1996 and 1998 audits. The same selection criteria and rating format were used. Most 2000 audit team members have participated in previous audits. Earlier audits, conducted in 1988 and 1989, were similar, but had differences in design, format and BMPs.

The 2000 Audit results continue the trend of overall improvement in the application and effectiveness of BMPs when compared to the previous audit results. Of special note is the improvement in application and, to a lesser degree, effectiveness of high risk BMPs. See Table 16 for a comparison of the 1990 through 2000 results.

Table 16
Comparison of BMP Audit Results – 2000 with 1998, 1996, 1994, 1992 and 1990

	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	92%	84%	81%	79%	72%	53%
Number of sites with at least one major departure in BMP application.	4 of 42 (9%)	8 of 47 (17%)	12 of 44 (27%)	17 of 46 (37%)	20 of 46 (43%)	27 of 44 (61%)
Average number of departures in BMP application, per site.	1.4	2.0	3.0	3.9	5.6	9
Percentage of practices providing adequate protection.	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection.	93%	89%	86%	83%	77%	58%
Number of sites having at least one major/temporary or minor/prolonged impacts.	9 of 42 (21%)	12 of 47 (26%)	15 of 44 (34%)	13 of 46 (28%)	17 of 46 (37%)	28 of 44 (64%)
Average number of impacts per site.	1.0	1.5	2.3	3	4.6	8

Ownership groups varied in their comparison to 1998 audit results.

Individual recognition is appropriate for the efforts and subsequent 2000 audit results of the Industry and Federal ownership groups. Industry made truly notable improvements. This is especially evident in High Risk BMPs. Their ratings improved from 84% to 97% in application and 87% to 99% in effectiveness of High Risk BMPs. In addition, Industry increased its percentage of sites with no departures and reduced its percentage of sites with ratings of 2 and 3.

Federal improvements, although not as dramatic as Industry, are quite noteworthy. Improvements were made in each category for which data was evaluated.

DNRC results varied between slight improvements and slight reductions depending on the categories observed. Overall their results were down from 1998, but no more than a few percentage points in a few areas.

NIPF sites were slightly down in many of the categories evaluated. Most notable, the percent of sites with no impacts dropped from 42% to 10%. As with DNRC the decreases are very small.

Most notable across all ownerships is that there were no ratings of "1" in either application or effectiveness.

With regards to improvements and reductions, it is appropriate to note these changes from the previous audit, especially where great improvements have occurred. With regard to reductions, because of the small sample size a relatively few downward changes can result in proportionally-large downward movement of percentages. No conclusions regarding an ownership's commitment to BMPs or technical expertise should be made based on data from a single years audit results.

Figures 4 through 8 offer graphical representation of the comparison of results between audits years 1990, 1992, 1994, 1996, 1998 and 2000.

Figure 4 displays the 1990 - 2000 audit results for BMP application.

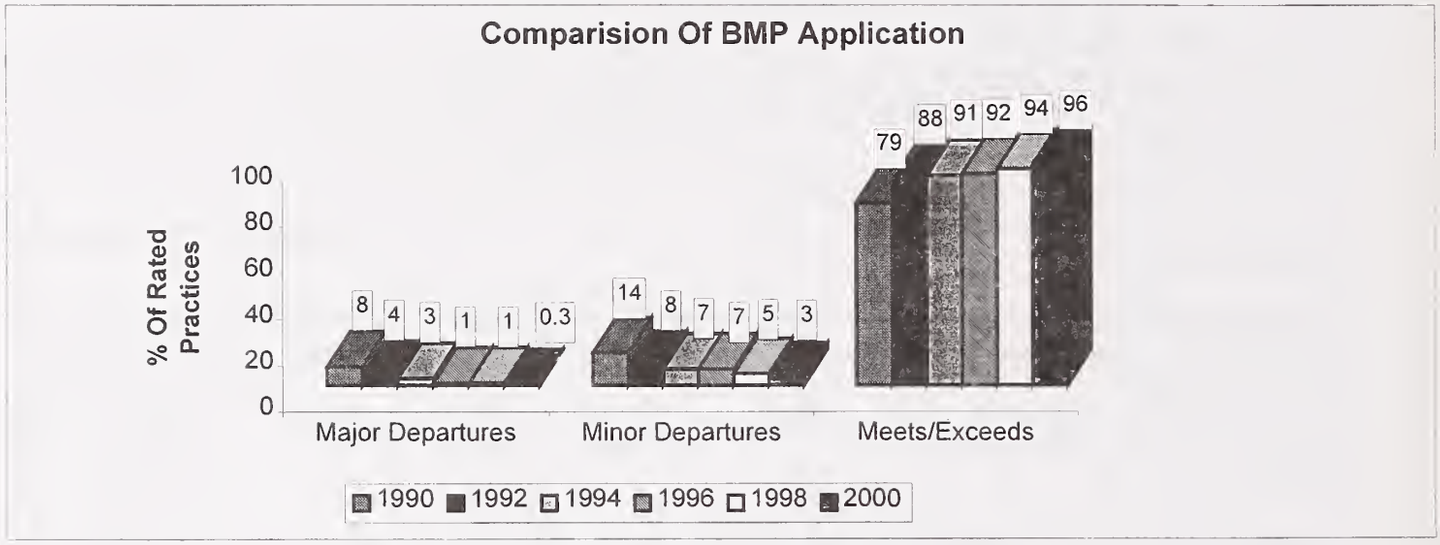

Figure 4

Major Departures Are Practices with an Application Rating < 3.
Minor Departures Are Practices with an Application Rating of 3.
Adequate or Exceeds Are Practices with an Application Rating > 3.

Figure 5 displays BMP effectiveness results of the 1990-2000 BMP audits.

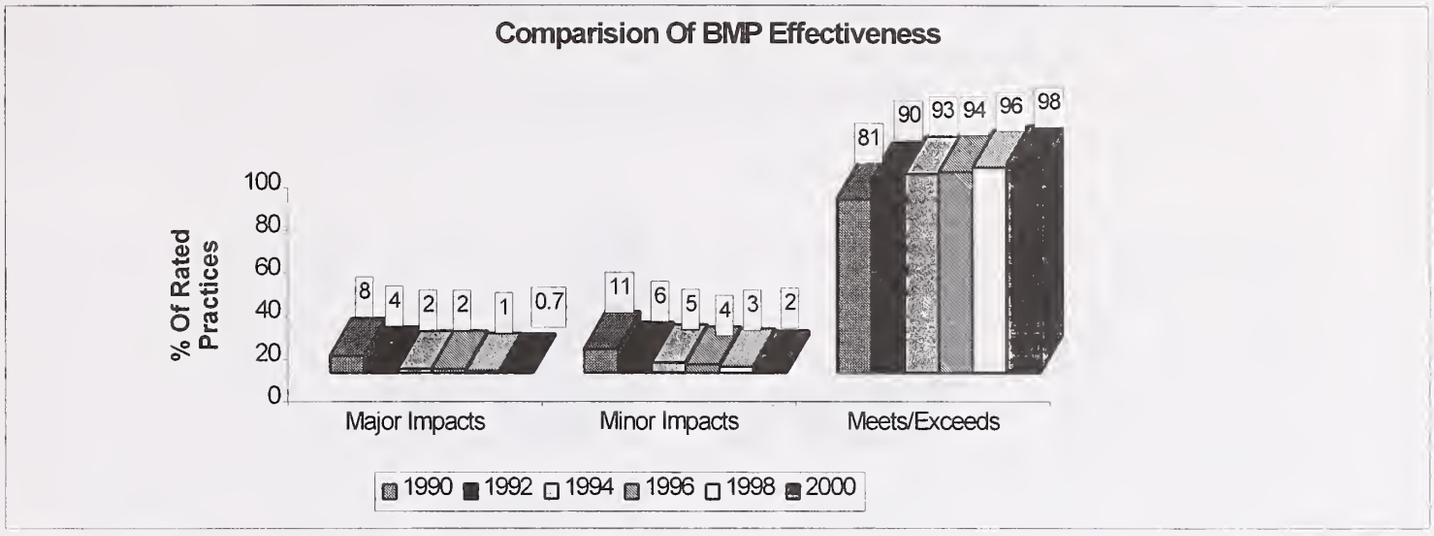

Figure 5

Major Impacts Are Practices with an Effectiveness Rating < 3. (See page 10– Rating Form)
Minor Impacts Are Practices with an Effectiveness Rating of 3.
Adequate Protection Is a Practice with an Effectiveness Rating > 3.

Figure 6 shows steady improvement in that, through time, fewer and fewer sites have major departures or impacts.

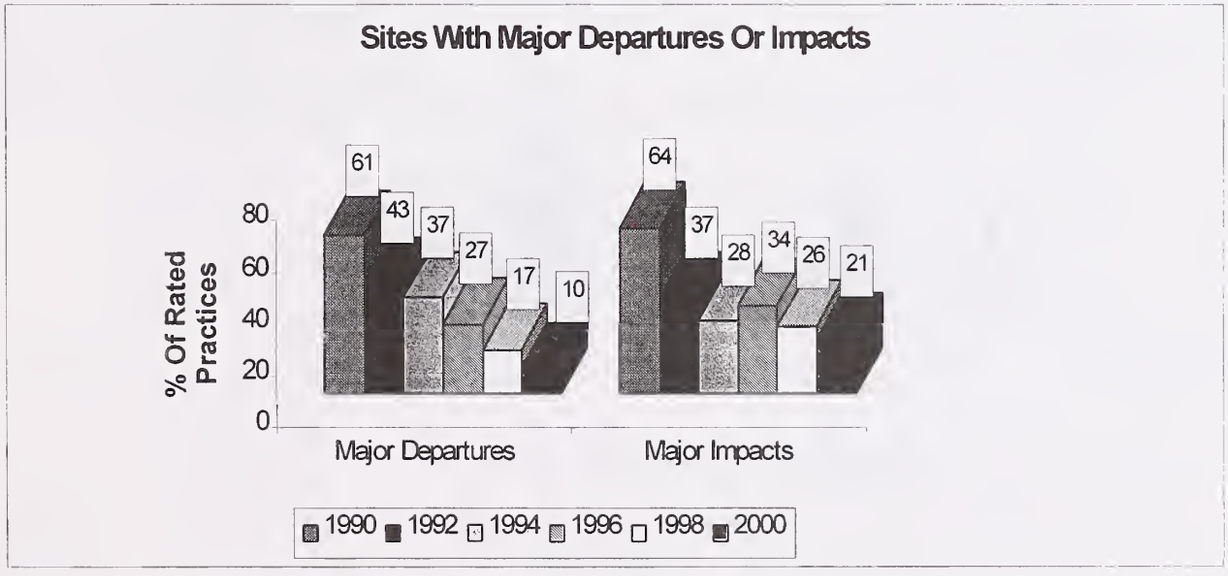

Figure 6

Major Departures Are Practices with an Application Rating of 1 or 2.
Major Impacts Are Practices with an Effectiveness Rating of 1 or 2 (See page 10— Rating Form).

The 2000 audits had fewer major departures and impacts per site than the previous audits. Figures 7 and 8 show the average number of impacts and departures per site.

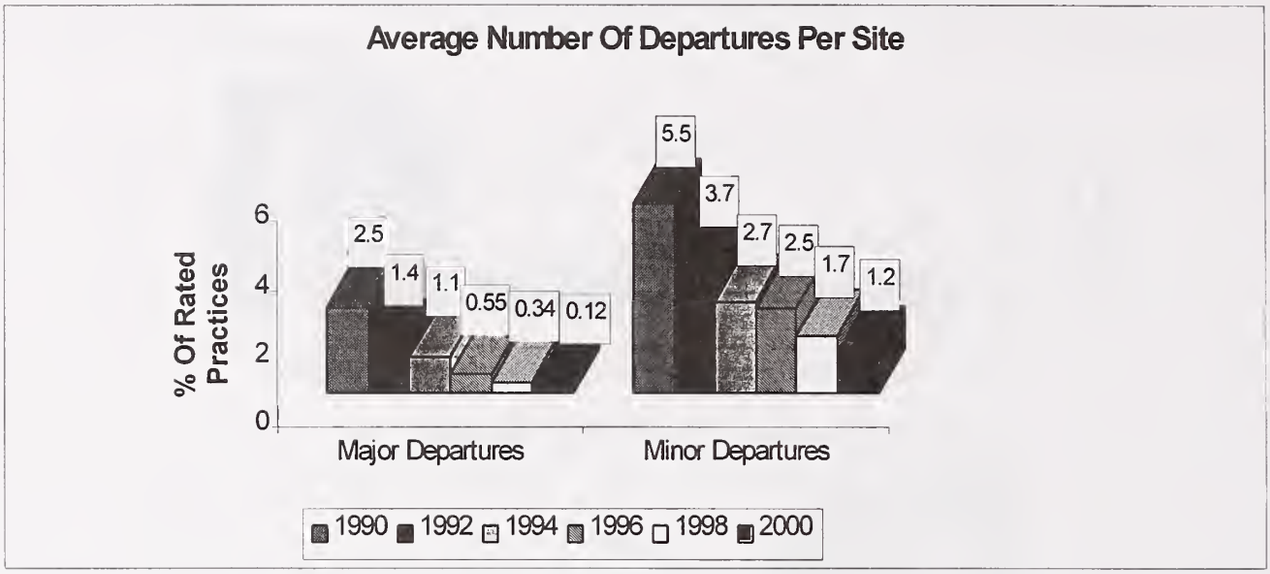

Figure 7

Major Departures are considered Practices with an Application Rating < 3 (See page 10--Rating Form).
Minor Departures are Practices with an Application Rating of 3.

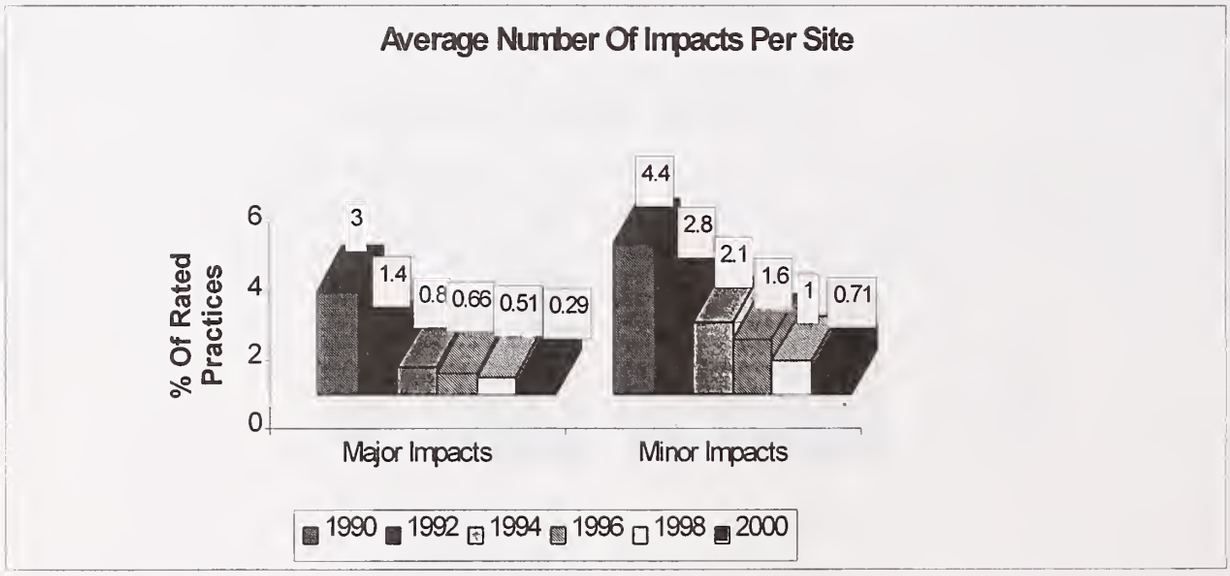

Figure 8

Major Impacts Are Practices with an Effectiveness Rating of < 3.
Minor Impacts Are Practices with an Effectiveness Rating of 3.

Reductions In Overall Sediment Delivery

Following the 1998 BMP audits, several members of the BMP Audit Technical Working Group (TWG) expressed a concern regarding the policy regarding awarding "5" ratings for BMP Effectiveness (see page 10, Rating Form). They believed the current policy may result in obscuring recognition of actual reductions in sediment delivery to streams when compared to pre-project conditions, and that these reductions in sediment are the result of improved protection to soil and water resources due to adequately applying BMPs.

As detailed in the discussion of the Rating Form beginning on page 10, a "5" for Effectiveness is defined as "Improved protection of soil and water resources over pre-project conditions." Thus, if a BMP is applied adequately and its application leads to improved protection over pre-project conditions, the effectiveness rating for that practice would be a "5." In actuality the audit rating policy does not exactly follow the Effectiveness "5" definition. At some point during audit history it was decided that if a BMP practice was applied such that the requirements of the BMP were met, this would provide adequate protection and thus receive an effectiveness rating of "4." Effectiveness ratings of "5" are in fact only given if the protection provided is extraordinary or more than adequate; for example, installing a bridge for fish passage when a CMP would have met the BMP requirement. It was pointed out that due to this rating policy, there may be and probably are projects where application of BMPs has brought on-the-ground conditions up to BMP standards and is resulting in reductions in sediment delivery over pre-project conditions due to improved protection. If this improvement is occurring, the rating policy is obscuring this improvement. The question was asked as to how this could be evaluated and the results presented in the Audit Report.

The TWG decided to add a new question to the BMP Audit Form (Appendix G). This new Yes/No question is found in Section VII of the Audit Form and reads, "Project included road improvements to existing road system that reduced overall sediment delivery to streams." The teams were asked to do a visual qualitative assessment of each audited project's post-project road system and, when possible, determine if improvements resulted in a reduction in sediment delivery to streams. The results of that new question are provided in Table 17.

Table 17

Overall Sediment Reduction Over Pre-Project Condition

Landowner	# Sites Audited	# Sites Applicable	Number Yes	Number No
DNRC	5	5	5	0
FEDERAL	9	8	7	1
INDUSTRY	18	15	13	2
NIPF	10	7	6	1
TOTALS	42	35	31	4

Results indicate that at 87% of the applicable audit sites, sediment delivery to streams from existing roads has been reduced over pre-project conditions.

Existing roads are defined as road systems in place prior to commencement of activities on the audited project. This question did not apply to project areas unroaded prior to commencement of activities on the audited project.

It should be noted that a "Yes" determination does not necessarily mean that there is no sediment delivery occurring post-project. A "Yes" indicates that the current status regarding delivery is improved over pre-project conditions. A "No" determination does not mean that conditions have worsened, nor that no improvements were made to the existing road system. A "No" indicates that any improvements made did not lead to reductions over pre-project conditions.

The TWG will evaluate the wording, rating format, and usefulness of the question and determine if it should be retained as is, modified, or eliminated from the 2002 audits.

Photo #8. Team Members Measure The Size Of A Rock-Armored Culvert

CONCLUSIONS

This final section will provide concluding remarks. The remarks will focus on addressing the objectives of the Best Management Practices audits as outlined on page 5.

Determine if BMPs are being applied on timber harvest operations.

With regards to the sites audited, it can be conclusively stated that audited BMPs are being applied and applied correctly at a very high rate. There were no sites audited where evidence of BMP application was not present. Across the state BMPs are well established as the Montana forestry standard for timber harvest practices. Although the sites selected represent only sites meeting specific criteria (page 7), it is believed by the author (DNRC) that the conclusions based on the sites audited can be extended to the non-sample population, especially if there is water associated with the project.

Evaluate the general effectiveness of BMPs in protecting soil and water resources.

Conclusions drawn from audit results over the past 10 years are very consistent and straightforward; when BMPs are applied correctly, they are very effective in the protection of soil and water resources.

Provide information on the implementation of the SMZ law and rules and evaluate the general effectiveness of SMZ's in protecting water quality.

The 2000 audit data continues to show that the SMZ law and rules are being applied across the state. These results are consistent with DNRC's enforcement program. DNRC enforcement records show that the number of law and rule violations across the state are generally few and that the impacts associated with these violations are generally minor and easily repairable. The 2000 audit data continues to support the contention that SMZ law and rules are effective in protecting water quality with regards to the prohibited practices.

Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation.

The audit results do not indicate a need to put special informational or educational efforts into an specific region of the state. All regions appear to have about the same distribution of adequate application and departures.

A list of top priority issues or subject areas and recommendations for education and information are as follows.

- Fisheries issues and TMDL's. Discern and educate regarding the proper technical applications and criteria to evaluate fish in relation to water quality.
- Work with Conservation Districts, county road maintenance programs and other water quality related parties to communicate the big picture of BMPs and how we can interact for the improvement of water quality.

- Continue education and information sharing on road surface drainage issues. They continue to be the source of the majority of BMP departures.

- Consider ways to reach more woods workers and especially landowners regarding BMPs and SMZs.

- Consider informational presentations of SMZ law and rule and BMPs and BMP process in university classes.

- Continue the relationship and educational efforts of DNRC and MLA in the BMP and SMZ workshops for woods workers. Consider trying to enlarge its sphere of influence in consideration of the previous bullet.

- Continue to work with audit team members in meeting their needs for information and clarification of audit issues and continue to present that information during the audit calibration audits.

Provide information on the need to revise, clarify or strengthen BMPs.

Audit team leaders and team members met on October 5, 2000 to discuss the 2000 field audits and the audit process in general. Team members who could not attend were invited to submit verbal or written comments. The October 5 meeting resulted in a list of concerns, requests and recommendations for the BMP Audit Technical Working Group to respond to. The BMP Technical Working Group (TWG) met on October 18, 2000 to review the team member recommendations and requests. The October 18th meeting was only able to address a limited number of the recommendations and requests, and a second TWG meeting is being scheduled for March 2001.

What follows is a summary of the recommendations and requests submitted by audit team members to the TWG. For a complete text of either meeting's minutes, contact the Montana Department of Natural Resources and Conservation, Service Forestry Bureau, in Missoula, MT.

- It is recommended that BMP Audits be continued and the next audits occur in the year 2002.

- Develop a format or process that looks ahead to the next five years anticipating BMP-related issues and needs. Evaluate our current BMPs and audit process in light of anticipated issues and needs and be sure our BMPs and audit process are sufficient to meet those se issues and needs.

- Fisheries issues, especially fish passage, are difficult for the audit teams to rate in the field. The teams request the TWG to assess where the audit process needs to go over the next five years with regard to fishery issues and provide, for the next audit cycle, field indicators for audit teams to use in evaluating fish-related BMPs.

- The teams recommend the TWG revisit the "5" rating discussion with the intent of providing specific direction that clarifies when "5's" are warranted.

- The audit teams request guidance regarding team members taking pictures during audits.

- Conservation Districts (CD) and the audits are linked by the 310 permitting process. There are some differences in the underlying philosophies between CD's and the audit process that result in team difficulties in rating BMP practices related to permits. Initiate discussions with the CD program heads to try to find common ground.

- There is confusion regarding the rating of practices linked to 310 and 124 permits. Please clarify the guidance.

- In consideration of changes in stream buffers and reduced volume per acre harvesting, review the audit minimum site selection criteria to determine the need for modifications and make appropriate changes.

- Revisit the decision not to rate third-party road departures and impacts and decide if the current policy is still appropriate.

- The audits focus on completed projects. Consider incorporating ongoing projects in the audit process.

- Should reaudits be included as part of future BMP audits?

- The teams recommend that DNRC and the TWG continue to address rating calibration concerns expressed by audit teams and continue the calibration training effort prior to BMP field audits.

- Provide in the audit ratings some provision to recognize BMP deficiencies on existing roads where complete solutions are long-term.

- Recommendations for minor changes to the BMP Audit Form.

- Continue to pursue educational opportunities such as the Montana Logging Association/DNRC workshops in SMZ and BMP training. Try to expand on this training to reach private landowners. NIPF landowners need a more complete understanding of BMPs and especially the audits.

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APPENDIX A

1997 BEST MANAGEMENT PRACTICES

BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA
December 1997

* - Practices not rated as part of BMP audits

I. DEFINITIONS

1. "Hazardous or toxic material" means substances which by their nature are dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.

2. "Stream," as defined in 77-5-302(7), MCA, means a natural water course of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.

3. "Streamside Management Zone (SMZ)" or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.

4. "Wetlands" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.

5. Adjacent wetlands are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.

6. Isolated wetlands lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

II. STREAMSIDE MANAGEMENT

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside management zones (SMZ). The "Montana Guide to the Streamside Management Zone & Rules" is an excellent information source describing management opportunities and limitations within SMZs.

III. ROADS

A. Planning and Location

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.

2. Review available information and consult with professionals as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials. *

3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.

4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, seeps, wetlands, wet meadows, and natural drainage channels.

5. Minimize the number of stream crossings and choose stable stream crossing sites.

6. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance. *

B. Design

1. Properly design roads and drainage facilities to prevent potential water quality problems from road construction.*

2. Design roads to the minimum standard necessary to accommodate anticipated use and equipment. The need for higher engineering standards can be alleviated through proper road-use management.

3. Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible.*

4. Design roads to minimize disruption of natural drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.

C. Drainage from Road Surface

1. Provide adequate drainage from the surface of all permanent and temporary roads. Use outsloped, insloped or crowned roads, and install proper drainage

features. Space road drainage features so peak flow on road surfaces or in ditches will not exceed capacity.

a. Outsloped roads provide a means of dispersing water in a low-energy flow from the road surface. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety can be met.

b. For in-sloped roads, plan ditch gradients steep enough, generally greater than 2% but less than 8%, to prevent sediment deposition and ditch erosion. The steeper gradients may be suitable for more stable soils; use the lower gradients for less stable soils.

c. Design and install road surface drainage features at adequate spacing to control erosion; steeper gradients require more frequent drainage features. Properly constructed drain dips can be an economical method of road surface drainage. Construct drain dips deep enough into the subgrade so that traffic will not obliterate them.

2. For ditch relief culverts, construct catch basins with stable side slopes. Protect the inflow end of crossdrain culverts from plugging and armor if in erodible soil. Skew ditch relief culverts 20 to 30 degrees toward the inflow from the ditch to help maintain proper function.

3. Where possible, install culverts at the gradient of the original ground slope; otherwise, armor outlets with rock or anchor downspouts to carry water safely across the fill slope.*

4. Provide energy dissipaters (rock piles, slash, log chunks, etc.) where necessary to reduce erosion at outlet of drainage features. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.

5. Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.*

6. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn't reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.

D. **Construction** (See Also Section IV on Stream Crossings)

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.*

2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means.

3. At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment. When done concurrently with road construction, this is one method that can effectively control sediment movement, and it can also provide an economical way of disposing of roadway slash. Limit the height, width and length of "slash filter windrows" so wildlife movement is not impeded. Sediment fabric fences or other methods may be used if effective.

4. Minimize earthmoving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.*

5. Construct cut and fill slopes at stable angles to prevent sloughing and other subsequent erosion.

6. Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.

7. Consider road surfacing to minimize erosion.*

8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.

9. Minimize sediment production from borrow pits and gravel sources through proper location, development and reclamation.

10. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety; avoid disturbing stable road surfaces. Prior to reconstruction of existing roads within the SMZ, refer to the SMZ law. Consider abandoning existing roads when their use would aggravate erosion.

E. **Maintenance**

1. Grade road surfaces only as often as necessary to maintain a stable running surface and adequate surface drainage.

2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.

3. Avoid cutting the toe of cut slopes when grading roads, pulling ditches, or plowing snow.

4. When plowing snow, provide breaks in snow berm to allow road drainage.*

5. Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid sidecasting in locations where erosion will carry materials into a stream.*

6. Avoid using roads during wet periods if such use would likely damage the road drainage features. Consider gates, barricades or signs to limit use of roads during spring break up or other wet periods.

7. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.*

8. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify; and, if necessary, recontour and provide water bars or drain dips.

IV. TIMBER HARVESTING, AND SITE PREPARATION

A. Harvest Design

1. Plan timber harvest in consideration of your management objectives and the following:*

    a. Soils and erosion hazard identification.

    b. Rainfall.

    c. Topography.

    d. Silvicultural objectives.

    e. Critical components (aspect, water courses, landform, etc.).

    f. Habitat types.

    g. Potential effects on water quality and beneficial water uses.

        1) Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.

        2) Wildlife habitat.

2. Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.

3. Use the economically feasible yarding system that will minimize road densities.*

4. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.*

5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.

6. Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.

B. **Other Harvesting Activities**

1. Tractor skid where compaction, displacement, and erosion will be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.

2. Avoid operation of wheeled or tracked equipment within isolated wetlands, except when the ground is frozen (see Section VI on winter logging).*

3. Use directional felling or alternative skidding systems for harvest operations in isolated wetlands.*

4. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.

5. Insure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.

6. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch will retard erosion.*

C. **Slash Treatment and Site Preparation**

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.*

2. When piling slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.

3. Minimize or eliminate elongated exposure of soils up and down the slope during mechanical scarification.*

4. Scarify the soil only to the extent necessary to meet the resource management objectives. Some slash and small brush should be left to slow surface runoff, return soil nutrients, and provide shade for seedlings.

5. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.

6. Carry out scarification on steep slopes in a manner that minimizes erosion. Broadcast burning and/or herbicide application is preferred means for site preparation, especially on slopes greater than 40%.

7. Remove all logging machinery debris to proper disposal site.*

8. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

V. STREAM CROSSINGS

A. **Legal Requirements**

1. Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, riprapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits.

   Before beginning such a project, the operator must submit a permit application to the conservation district indicating the location, description, and project plans. The evaluation generally includes on-site review, and the permitting process may take up to 60 days.

2. Stream-crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process (administered by the Department of Fish, Wildlife and Parks), rather than the 310 permit.

3. A short-term exemption (3a authorization) from water quality standards is necessary unless waived by the Department of Fish, Wildlife and Parks as a condition of a 310 or 124 permit. Contact the Department of Environmental Quality in Helena at 444-2406 for additional information.

B. **Design Considerations** (Note: 310 permit required for perennial streams)

1. Cross streams at right angles to the main channel if practical. Adjust the road grade to avoid the concentration of road drainage to stream crossings. Direct drainage flows away from the stream crossing site or into an adequate filter.

2. Avoid unimproved stream crossings. When a culvert or bridge is not feasible, locate drive-throughs on a stable, rocky portion of the stream channel.

C. **Installation of Stream Crossings** (Note: 310 permit required for perennial streams)

1. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.

2. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provides seasonal fish passage. Ensure fish movement is not impeded. Place culverts slightly below normal stream grade to avoid culvert outfall barriers. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage.

3. Design stream-crossings for adequate passage of fish (if present), minimum impact on water quality, and at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill.

4. Install culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where feasible.

5. Consider dewatering stream crossing sites during culvert installation.*

6. Maintain a 1-foot minimum cover for culverts 15 to 36 inches in diameter, and a cover of one-third diameter for larger culverts, to prevent crushing by traffic.

7. Use culverts with a minimum diameter of 15 inches for permanent stream crossings and cross drains.*

VI. Winter Logging *

A. General *

1. Consider snow-road construction and winter harvesting in isolated wetlands and other areas with high water tables or soil erosion and compaction hazards.

2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to prevent rutting or displacement of soil. Be prepared to suspend operations if conditions change rapidly, and when the erosion hazard becomes high.

3. Consult with operators experienced in winter logging techniques.

B. Road Construction and Harvesting Considerations *

1. For road systems across areas of poor bearing capacity, consider hauling only during frozen periods. During cold weather, plow any snow cover off of the roadway to facilitate deep freezing of the road grade prior to hauling.

2. Before logging, mark existing culvert locations. During and after logging, make sure that all culverts and ditches are open and functional.

3. Use compacted snow for road beds in unroaded, wet or sensitive sites. Construct snow roads for single-entry harvests or for temporary roads.

4. In wet, unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations only when adequate snow depth exists. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.

5. Return the following summer and build erosion barriers on any trails that are steep enough to erode.

VI. HAZARDOUS SUBSTANCES

A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.

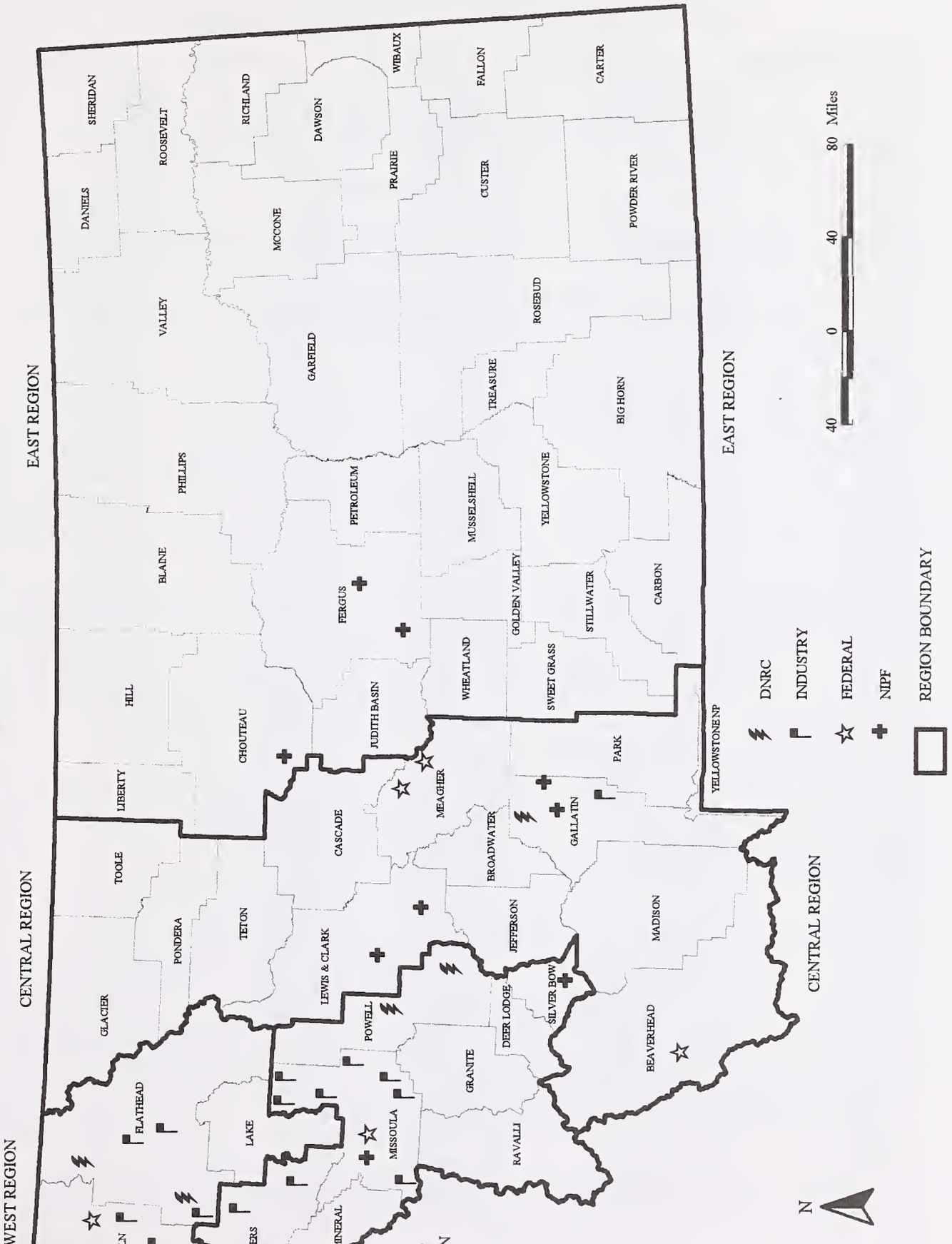
2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.*

B. **Pesticides and Herbicides ***

1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive and chemical means.

2. To enhance effectiveness and prevent transport into streams, apply chemicals during appropriate weather conditions (generally calm and dry) and during the optimum time for control of the target pest or weed.

APPENDIX - B
2000 BMP Audit Site Location Map



APPENDIX C

2000 BMP FIELD AUDITS
SITES PICKED FOR AUDITS BY OWNERSHIP GROUP

SITE NUMBER	SALE NAME	COUNTY	OWNER	TEAM
FED-1	Spring Basin	Meagher	USFS	East
FED-2	Tenderfoot	Meagher	USFS	East
FED-3	Burnt Lion	Sanders	USFS	West
FED-4	Northside	Missoula	USFS	West
FED-5	Maxine Creek	Lincoln	USFS	Northwest
FED-6	Detgen Cowell	Lincoln	USFS	Northwest
FED-7	Studebaker	Lincoln	USFS	Northwest
FED-8	Silver Horse	Lincoln	USFS	Northwest
FED-9	Bloody Dick	Beaverhead	USFS	Central
DNRC-1	Mule Creek	Gallatin	DNRC	Central
DNRC-2	Cooper Creek	Powell	DNRC	Central
DNRC-3	Avon South #1	Powell	DNRC	Central
DNRC-4	Flathead Mine	Flathead	DNRC	West
DNRC-5	Spring Rock	Flathead	DNRC	Northwest
IND-1	BTN-34	Gallatin	R-Y TIMBER	Central
IND-2	Meadow Lake	Flathead	PCTC	Northwest
IND-3	More Milk	Lincoln	PCTC	Northwest
IND-4	Marlboro Line	Lincoln	PCTC	Northwest
IND-5	Raven 900	Lincoln	PCTC	Northwest
IND-6	Johnson Mech	Lincoln	PCTC	Northwest
IND-7	Catch 22 Line	Flathead	PCTC	Northwest
IND-8	Miller View Line	Lincoln	PCTC	Northwest
IND-9	O'Neil NW 29-Sel	Flathead	STOLTZ	Northwest
IND-10	Lincoln Davis Line	Sanders	PCTC	West
IND-11	West Fork Tractor	Sanders	PCTC	West
IND-12	Rummy Dog	Missoula	PCTC	West
IND-13	Stoner Flatt	Missoula	PCTC	West
IND-14	Buckaroo	Missoula	PCTC	West
IND-15	Horsefish	Missoula	PCTC	West
IND-16	Dam Beaver	Missoula	PCTC	West
IND-17	Lost 35	Missoula	PCTC	West
IND-18	Slucination	Missoula	PCTC	West
NIPF-1	Seven-Up Pete -	Lewis&Clark	PVT	East
NIPF-2	LP –M, Morgan	Gallatin	PVT	Central
NIPF-3	R-Y, Allen Woosley	Gallatin	PVT	Central
NIPF-5	Don Lehman	Chouteau	PVT	East
NIPF-6	PML, Allan Aldrick	Fergus	PVT	East
NIPF-7	PML, Dee Boyce	Fergus	PVT	East
NIPF-8	Kirk Mace	Missoula	PVT	West
NIPF-9	Bill Garrison	Silverbow	PVT	Central
NIPF-11	Tom Jones	Lincoln	PVT	Northwest
NIPF-12	Sterling Ranch	Lewis & Clark	PVT	Central

APPENDIX D

SAMPLE AUDIT SITE INFORMATION FORM

BPM AUDIT SITE INFORMATION FORM
NIPF

Please complete this sheet for each site that meets minimum criteria.
Please attach a sale area map for each site.

Minimum Criteria

(1) Timber harvested in **Calendar Years** 1998, 1999, and 2000 **Through March 31, 2000**, **and**
(2) Some portion of the sale (cutting unit) is located within 200 feet of a stream, **and**
(3) Minimum size of 5 acres and 5,000 BF/acre (westside), 3,000 BF/acre (eastside)

HRA Number _____
Landowner Name _____
Contractor Name _____
Sale Name _____
Legal Description Section____ TWN ____ RNG ____ County_____
Primary Drainage _____

New Road Construction Yes ___ No ___ Miles _____ Yr. Complete_____
Reconstruction Yes ___ No ___ Miles _____ Yr. Complete_____
Stream Crossings Yes ___ No ___
Culvert Installation Yes ___ No ___
Slash Disposal Complete Yes ___ No ___

Stream Within 200 Feet Of A Unit Yes ____ No ____
Stream Name _____ Bankfull Width _____
Stream Class (SMZ Law Definition) _____

For Units Within 200 Feet Of A Stream

Unit Size _____ Unit Number_____ Volume Removed _____
Month/Year Harvested_____
Riparian Harvest Yes ___ No ___
Average Slope _____
Geologic Parent Material _____

Skidding/Yarding Method (Circle the method closest to what was applied on the ground)

Tracked Equipment, Rubber Tired Skidder, Partial Suspension, Full Suspension

Harvest Method Partial Cut _____ Clearcut _____

APPENDIX E

2000 BMP FIELD AUDITS
RISK RATING GUIDE

MONTANA "RISK" MATRIX (3/91)

TYPE		CLEAR-CUT				PARTIAL CUT				SITE PREP			ROADS	
SLOPE	SOIL EROD	TERQAUCIKPED	RSUKBIBDER	PSAURSTPIAL	FSUULLSP	TERQAUCIKPED	RSUKIBBDER	PSAURSTPIAL	FSUULSLP	MPACHILE/SINCAR	BBURDCAST	OTHER	PERM	TEMP
0-5%	H	2	2	2	1	2**	2**	1	1	2	1	1	2**	3
	M	2	1	1	1**	2	1**	1	1	2**	1	1	1	1
	L	1	1	1	1	1	1	1	1	2	1	1	1	1
5-20%	H	4	3	2	1	4*	3	2	1	4	2	1	3	4
	M	3	2	1	1	3*	2	1	1	3	2	1	2	3
	L	2	2	1	1	2*	2*	1	1	2	1	1	2	2
20-40%	H	5	5	4*	2	5*	5*	3**	1	5	3**	1	4	5
	M	4*	4	3	1	3	3	2	1	4	3	1	3	4*
	L	3*	2	2	1	2	2	2	1	3	2	1	3*	3
>40%	H	5	5	4	2	5	5	4	2	5	4	1	5	5
	M	5	5	4	2*	5	5	3	1	5	4	1	5	5
	L	4	4	3	1	4	4	2	1	4	3*	1	4	4

(* Indicates Mean Value Used, ** Final Group Consensus Adjustment for Internal Consistency)

MONTANA EROSION-IMPACT MATRIX

From: "Management Guidelines for Riparian Forests" by Robert Pfister and Kim Sherwood. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program.

LEGEND

1 = LOW RISK 2-3 = MODERATE RISK 4-5 = HIGH RISK

SOIL ERODIBILITY

HIGH ERODIBILITY	MODERATE ERODIBILITY	LOW ERODIBILITY
GRANITICS	SCHIST	ARGILLITE/QUARTZITE
ALLUVIUM	SOFT/HARD SEDIMENTS	METAMORPHIC (BELT)
LACUSTRINE	BASIC IGNEOUS	

HIGH RISK DUE TO RIPARIAN HARVEST

"HIGH" risk will be assigned to sales with logging in riparian zones along streams. Riparian zones are located between aquatic and terrestrial environments are identified by distinct vegetation that requires or tolerates free or unbound water. This includes but is not limited to the following habitat types: ABLA/CACA, (all phases), ABLA/APHO, PICEA/EQAR, THPL/OPHO.

APPENDIX F

BMP AUDIT TEAM MEMBERSHIP

	NORTHWEST	WEST	CENTRAL	EAST
FISHERIES	Scott Rumsey, DFWP+ (Tom Weaver, DFWP)+ (Mike Hensler, DFWP)+	Chris Clancy, DFWP+ (Ladd Knoteck, DFWP) (Duane Phinney DFWP)	Don Skaar, DFWP+ (Jim Magee, DFWP) (Scott Opitz, DFWP)	Joel Tohz, DFWP (Michael Enk, USFS)*
HYDROLOGY	Steve Johnson, USFS+ (Brian Sudgen, PCTC)+	George Mathieus, DNRC+ (Gary Frank, DNRC)+	Steve Hayes, PCTC+ John Whittingham, BLM	Bo Stuart, USFS+ Mark Nienow, USFS+
SOILS	Bill Basko, USFS+ (Lou Kuennen, USFS)	Tim Wiersum, NRCS+ (Neal Svendsen, NRCS)	Wayne Barndt, PVT+ (Jeff Collins, DNRC)	Bob Logar, NRCS+ Hal Hunter, PVT +
FORESTRY	**Russ Hudson**, PVT+* (Allen Wolf), DNRC	Dick Wick, PCTC+ (Jim Mountjoy, SC)+	**Rick Franke**, SS+* (Steve Flynn, LP)+	**Gordy Sanders** PML+*
ENGINEERING AND ROADS	Vic Andersen, PCTC+ (Ron Buentimeier, Stoltze)+	**Jim Saubier, USFS+** (Eric Trimble, DNRC)	Bob Korb, USFS+ (D.J. Bakken, DNRC)	Mike Montgomery, BLM (Dennis Davaz, R-Y)
CONSERVATION	(Tom Hope, TU) (Dan Paschke, TU)+	Bob Benson, CFC+ (Marnie Criley, Wild. CPR)	Judi Brawer, Amer. Wild.+ (Kim Davitt, Amer. Wild)+ (Deboran Kmon, Amer. Wild.)+	O'Brien Hollow, MEIC+ (Shawn Regerus, PCA)
NIPF/LOGGER	Fred Hodgboom, MOFA+ (Tom Jones, MOFA)+	Pat Kearney, MLA (Mike Schlegel, MLA)	Brent Anderson, MLA+ (Doug Mote, MLA) (Howard Dixon, MLA)	Russ Gregory, MFOA+ (Cynthia Kingston, MFOA)

\+ Denotes Past Experience
* Denotes Team Leader
(*) Denotes Alternate Team Leader
() Denotes Alternate Team Member

APPENDIX G

DS49
Rev 6/00

BMP FIELD AUDITS
SITE INFORMATION

Site Number: _____ Meets Selection Criteria:_____
High Hazard:_____

Site Name:_____

Owner:_____

Legal Description: _____ County:_____

Primary Drainage: _____ Month/Year Harvested:_____

Stream Within 200 Ft.? Y / N Name: _____ Bankfull Width:_____

Unit Size: _____ Volume Removed:_____

Road Construction: _____ Length:_____

Road Reconstruction: _____ Length:_____

Slash Disposal Complete: _____ Method:_____

Logging Method:_____

Slope: 0-5%_____;5-20%_____;20-40%_____;40%+ _____

Parent Material:_____

Soil Erodibility: High___Medium___ Low___

Harvest in Riparian: Y / N

Stream Class:_____

Comments:

Rating Guide

APPLICATION
5– OPERATION EXCEEDS REQUIREMENTS OF BMP.
4– OPERATION MEETS REQUIREMENTS OF BMP.
3– MINOR DEPARTURE FROM BMP.
2– MAJOR DEPARTURE FROM BMP.
1– GROSS NEGLECT OF BMP.

EFFECTIVENESS
5– IMPROVED PROTECTION OF SOIL AND WATER RESOURCES OVER PRE-PROJECT CONDITION.
4– ADEQUATE PROTECTION OF SOIL AND WATER RESOURCES.
3– MINOR AND TEMPORARY IMPACTS ON SOIL & WATER RESOURCES.
2– MAJOR AND TEMPORARY OR MINOR AND PROLONGED IMPACTS ON SOIL AND WATER RESOURCES.
1– MAJOR AND PROLONGED IMPACTS ON SOIL AND WATER RESOURCES.

DEFINITIONS (BY EXAMPLE):
ADEQUATE– SMALL AMOUNT OF MATERIAL ERODED; MATERIALD DOES NOT REACH DRAWS, CAHNNELS, OR FLOODPLAIN.
MINOR– EROSION AND DELIVERY OF MATERIAL TO DRAWS BU TNOT STREAM.
MAJOR– EROSION AND SUBSEQUENT DELIVERY OF SEDIMENT TO STREAM OR ANNUAL FLOODPLAIN.
TEMPORARY– IMPACTS LASTING ONE YEAR OR LESS; NO MORE THAN ONE RUNOFF SEASON.
PROLONGED– IMPACTS LASTING MORE THAN ONE YEAR.

NR– NOT REVIEWED NA– NOT APPLICABLE

FIELD AUDIT

Date:_____

Team Leader/Recorder:_____

Team Members:_____

_____

Observers Present:

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➤Reconstruction

	RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICABLE TO SITE (Y/N) APPLICATION	EFFECTIVENESS		COMMENTS
	SECTION III— ROADS				
	ROAD PLANNING & LOCATION SECTION III.A.				
➤+	1a. MINIMIZE NUMBER OF ROADS NECESSARY.				
#	1b. USE EXISTING ROADS UNLESS AGGRAVATE EROSION.				
+	3. AVOID LONG, SUSTAINED, STEEP ROAD GRADES.				
+	4. LOCATIONS AVOID HIGH HAZARD SITES (I.E., WET AREAS AND UNSTABLE SLOPES).				
+	5a. MINIMIZE NUMBER OF STREAM CROSSINGS. NUMBER _____.				
+	5b. CHOOSE STABLE STREAM CROSSING SITES.				
	ROAD DESIGN SECTION III.B.				
➤+	2. DESIGN ROADS TO MINIMUM STANDARD NECESSARY TO ACCOMMODATE ANTICIPATED USES.				
+	4. VARY ROAD GRADE TO REDUCE CONCENTRATED DRAINAGE.				
	DRAINAGE FROM ROAD SURFACE SECTION III.C.				
+➤#	1. PROVIDE ADEQUATE ROAD SURFACE DRAINAGE FOR ALL ROADS.				
+➤	2. PROTECT, STABILIZE AND SKEW ALL DITCH/RELIEF CULVERTS.				
+➤#	4. PROVIDE ENERGY DISSIPATERS AT DRAINAGE STRUCTURE OUTLETS WHERE NEEDED.				
+➤#	6. ROUTE ROAD DRAINAGE THROUGH ADEQUATE FILTRATION ZONES BEFORE ENTERING A STREAM.				
	CONSTRUCTION/RECONSTRUCTION SECTION III.D.				
+➤	2. STABILIZE ERODIBLE SOILS (I.E., SEEDING, BENCHING, MULCHING).				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➤Reconstruction

+➤	3. PROVIDE EFFECTIVE SEDIMENT CONTROL ON ERODIBLE FILL SLOPES.				
+➤	5. CUT AND FILL SLOPES AT STABLE ANGLES. SLOPE RATIO: _____.				
+➤	6. AVOID INCORPORATING WOODY DEBRIS IN ROAD FILL.				
+➤	8. EXCESS MATERIALS (WASTE) PLACED IN LOCATIONS THAT AVOID ENTERING STREAM.				
+➤	9. SEDIMENT FROM BORROW PITS AND GRAVEL PITS MINIMIZED.				
➤	10. RECONSTRUCT ONLY TO THE EXTENT NECESSARY TO PROVIDE ADEQUATE DRAINAGE AND SAFETY.				
ROAD MAINTENANCE SECTION III.E.					
+➤#	1. GRADE ROADS AS NECESSARY TO MAINTAIN DRAINAGE.				
+➤#	2. MAINTAIN EROSION CONTROL FEATURES (DIPS, DITCHES AND CULVERTS FUNCTIONAL).				
#	3. AVOID CUTTING THE TOE OF CUT SLOPES.				
+➤#	6. AVOID USE OF ROADS DURING WET PERIODS AND SPRING BREAKUP.				
+➤#	8. ABANDONED ROADS IN CONDITION TO PROVIDE ADEQUATE DRAINAGE WITHOUT FURTHER MAINTENANCE.				
SECTION IV--TIMBER HARVESTING					
HARVEST DESIGN SECTION IV.A.					
	2. SUITABLE LOGGING SYSTEM FOR TOPOGRAPHY, SOIL TYPE AND SEASON OF OPERATION.				
	5. DESIGN AND LOCATE SKID TRAILS TO AVOID CONCENTRATING RUNOFF.				
	6. SUITABLE LOCATION, SIZE, AND NUMBER OF LANDINGS.				

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➤Reconstruction

OTHER HARVESTING ACTIVITIES SECTION IV.B. 1a. SKIDDING OPERATION MINIMIZES SOIL COMPACTION AND DISPLACEMENT.				
1b. AVOID TRACTOR SKIDDING ON UNSTABLE SLOPES AND SLOPES THAT EXCEED 40% UNLESS NOT CAUSING EXCESSIVE EROSION.				
4. ADEQUATE DRAINAGE FOR LANDING				
5. ADEQUATE DRAINAGE FOR SKID TRAILS.				
SLASH TREATMENT AND SITE PREPARATION SECTION IV.C. 2. PILE SLASH SO AS TO PRESERVE THE SURFACE SOIL HORIZON.				
4. SCARIFY ONLY TO THE EXTENT NECESSARY TO MEET RESOURCE MANAGEMENT OBJECTIVE.				
5. ACTIVITIES LIMITED TO FROZEN OR DRY CONDITIONS TO MINIMIZE SOIL COMPACTION AND DISPLACEMENT.				
6. EQUIPMENT OPERATIONS ON SUITABLE SLOPES ONLY.				
8. LIMIT WATER QUALITY IMPACT OF PRESCRIBED FIRE.				
SECTION V--STREAM CROSSINGS				
LEGAL REQUIREMENTS SECTION V.A. ➤+ 1. PROPER PERMITS FOR STREAM CROSSINGS.				Y/N (Comments)*
DESIGN CONSIDERATIONS SECTION V.B. ➤+ 1a. CROSS STREAMS AT RIGHT ANGLES, IF PRACTICAL.				
➤+ 1b. DIRECT ROAD DRAINAGE AWAY FROM STREAM CROSSING SITE.				
➤+ 2. AVOID UNIMPROVED STREAM CROSSINGS.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➤Reconstruction

INSTALLATION OF STREAM CROSSINGS SECTION V.C.				
➤+ 1. MINIMIZE STREAM CHANNEL DISTURBANCE.				
➤+ 2. CULVERTS CONFORM TO NATURAL STREAMBED AND SLOPE.				
➤+ 3. PROPER SIZING FOR CROSSING STRUCTURES.				
➤+ 4. PREVENT EROSION OF CULVERT AND BRIDGE FILLS (I.E., ARMOR INLET AND OUTLET.				
➤ + 6. MINIMUM COVER FOR CULVERTS PROVIDED.				
SECTION VII--HAZARDOUS SUBSTANCE				
GENERAL				
1. ADEQUATE STORAGE AND DISPOSAL FOR FUEL,SHOP DEBRIS,AND WASTE OIL.				

# PROJECT INCLUDED ROAD IMPROVEMENTS TO EXISTING ROAD SYSTEM THAT REDUCED OVERALL SEDIMENT DELIVERY TO STREAMS.*	Y/N COMMENT

ADDITIONAL COMMENTS:

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➤Reconstruction

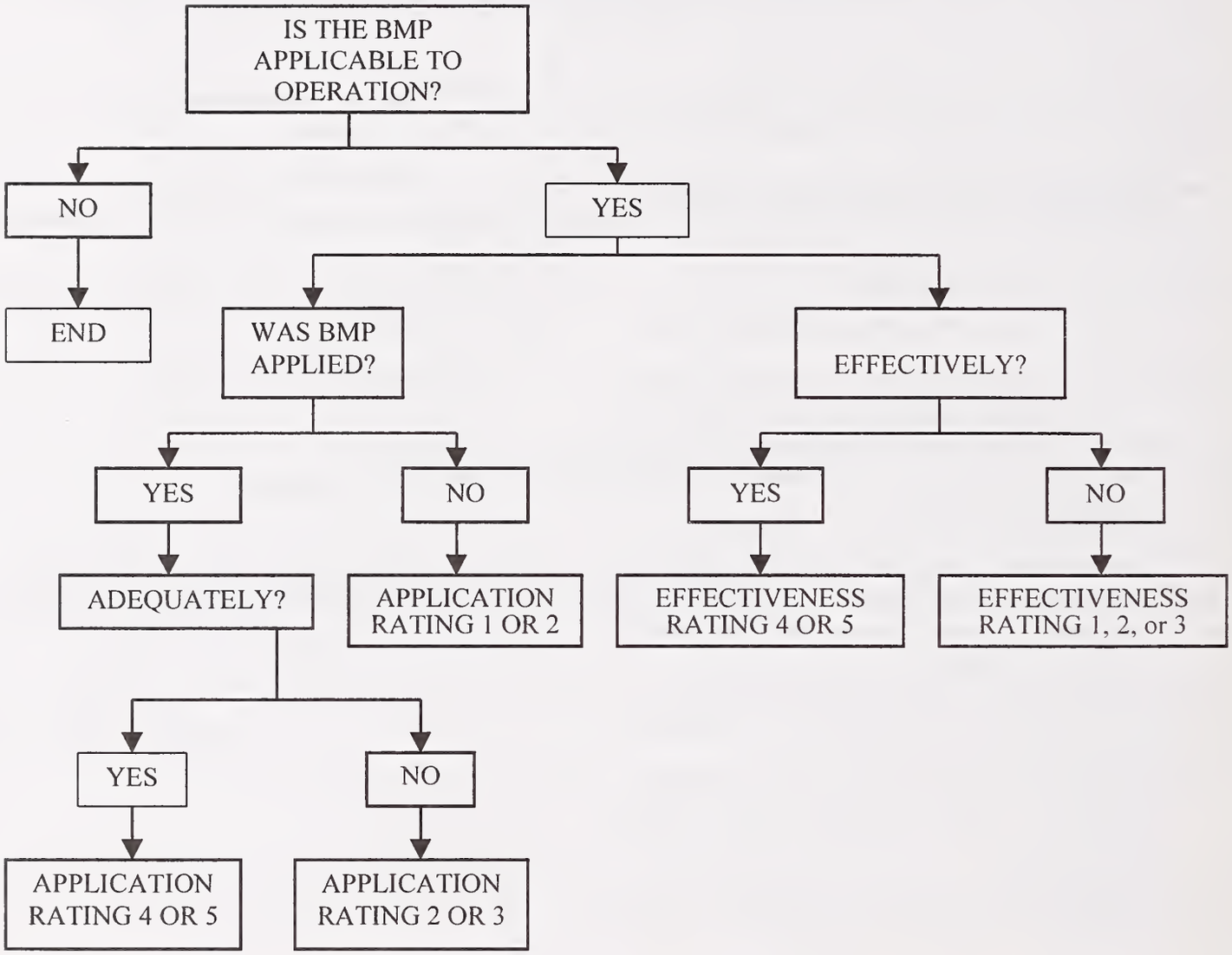
STREAMSIDE MANAGEMENT ZONE SITE INFORMATION	
WERE ANY PRE-APPROVED ALTERNATIVE PRACTICES UTILIZED? (* DENOTES PRACTICES THAT APPLY.)	Y / N (LIST APPLIED PRACTICES)
WERE ANY DNRC-APPROVED SITE-SPECIFIC ALTERNATIVE PRACTICES IMPLEMENTED IN THE HARVEST ACTIVITIES?	Y / N (LIST APPLIED PRACTICES)

RECOMMENDED BEST MANAGEMENT PRACTICES				COMMENTS
1.a ADEQUATE SMZ WIDTH MAINTAINED, AVG. WIDTH _____				
1.b SMZ PROPERLY MARKED?				
2. EXCLUSION OF BROADCAST BURNING IN SMZ.				
3. SMZ RETENTION TREE REQUIREMENTS MET. (# OF TREES, REPRESENTATIVE OF PRE-HARVEST STAND, FAVOR BANK-EDGE AND LEANING TREES, SHRUBS AND SUBMERCHANTABLE)				
4. EXCLUSION OF EQUIPMENT OPERATION IN SMZ EXCEPT ON ESTABLISHED ROADS				
5. EXCLUDE CONSTRUCTION OF ROADS IN THE SMZ EXCEPT WHEN NECESSARY TO CROSS A STREAM OR WETLAND.				
6. EXCLUSION OF ROAD FILL MATERIAL DEPOSITED IN SMZ EXCEPT AS NEEDED TO CONSTRUCT CROSSINGS.				
7. EXCLUSION OF SIDE-CASTING OF ROAD MATERIAL INTO A STREAM, LAKE, WETLAND OR OTHER BODY OF WATER DURING ROAD MAINTENANCE.				
8. EXCLUSION OF SLASH IN STREAMS, LAKES OR OTHER BODIES OF WATER.				
9. EXCLUDE THE HANDLING, STORAGE, APPLICATION OR DISPOSAL OF HAZARDOUS OR TOXIC MATERIALS IN THE SMZ IN A MANNER THAT POLLUTES OR CAUSES DAMAGE OR INJURY.				

ADDITIONAL COMMENTS:

APPENDIX H

RATIONALE FOR THE RATING SYSTEM
POST HARVEST EVALUATION



APPENDIX I

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
ROAD PLANNING													
Minimize # of Roads III.A.1a	DNRC	0	0	0	4	1	0	0	0	0	5	0	0
	FED	0	0	0	9	0	0	0	0	0	9	0	0
	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	41	1	0	0	0	0	42	0	0
Use Existing Roads III.A.1b	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	8	0	1	0	0	0	8	0	1
	IND	0	0	0	17	0	1	0	0	0	17	0	1
	NIPF	0	0	0	9	0	1	0	0	0	9	0	1
	Total:	0	0	0	39	0	3	0	0	0	39	0	3
Avoid Long, Steep Grades III.A.3	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	7	0	2	0	0	0	7	0	2
	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	40	0	2	0	0	0	40	0	2
Avoid High Hazard Areas III.A.4	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	7	0	2	0	0	0	7	0	2
	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	40	0	2	0	0	0	40	0	2
Minimize # of Stream X'ings III.A.5a	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	6	0	3	0	0	0	6	0	3
	IND	0	0	0	14	0	4	0	0	0	14	0	4
	NIPF	0	0	0	9	0	1	0	0	0	9	0	1
	Total:	0	0	0	34	0	8	0	0	0	34	0	8
Choose Stable Stream Crossing Sites III.A.5b	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	4	0	5	0	0	0	4	0	5
	IND	0	0	0	13	0	5	0	0	0	13	0	5
	NIPF	0	0	0	9	0	1	0	0	0	9	0	1
	Total:	0	0	0	31	0	11	0	0	0	31	0	11

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
ROAD DESIGN													
Minimum Design Standards III.B.2	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	9	0	0	0	0	0	9	0	0
	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0
Vary Grade for Drainage III.B.4	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	6	0	3	0	0	0	6	0	3
	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	39	0	3	0	0	0	39	0	3
ROAD DRAINAGE													
Adequate Surface Drainage III.C.1	DNRC	0	0	0	5	0	0	0	0	1	4	0	0
	FED	0	0	5	4	0	0	0	1	2	6	0	0
	IND	0	0	2	16	0	0	0	0	0	18	0	0
	NIPF	0	0	5	5	0	0	0	0	5	5	0	0
	Total:	0	0	12	30	0	0	0	1	8	33	0	0
Skew Relief Culverts III.C.2	DNRC	0	0	1	4	0	0	0	0	0	5	0	0
	FED	0	0	1	5	0	3	0	0	1	5	0	3
	IND	0	0	1	14	0	3	0	0	0	15	0	3
	NIPF	0	0	2	3	0	5	0	0	1	4	0	5
	Total:	0	0	5	26	0	11	0	0	2	29	0	11
Energy Dissip. at CMP Outlets III.C.4	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	8	0	1	0	0	0	8	0	1
	IND	0	1	1	15	0	2	0	0	1	15	0	2
	NIPF	0	0	1	8	0	1	0	0	10	8	0	1
	Total:	0	0	2	36	0	4	0	0	2	36	0	4
Route Drainage Through SMZ III.C.6	DNRC	0	0	0	5	0	0	0	0	1	4	0	0
	FED	0	1	0	8	0	0	0	2	1	6	0	0
	IND	0	0	2	15	0	1	0	0	1	16	0	1
	NIPF	0	0	2	8	0	0	0	0	1	9	0	0
	Total:	0	1	4	36	0	1	0	2	4	35	0	1

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
ROAD CONSTRUCTION													
Stabilize Erodible Soils III.D.2	DNRC	0	0	0	5	0	0	0	0	1	4	0	0
	FED	0	0	0	9	0	0	0	0	0	9	0	0
	IND	0	0	1	17	0	0	0	0	1	17	0	0
	NIPF	0	0	0	10	0	0	0	0	1	9	0	0
	Total:	0	0	1	41	0	0	0	0	3	39	0	0
Sediment Control Erodible Fill Slopes III.D.3	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	9	0	0	0	0	0	9	0	0
	IND	0	0	0	17	1	0	0	0	0	18	0	0
	NIPF	0	1	0	9	0	0	0	1	0	9	0	0
	Total:	0	1	0	40	1	0	0	1	0	41	0	0
Slopes at Stable Angle III.D.5	DNRC	0	0	1	4	0	0	0	0	0	5	0	0
	FED	0	0	0	9	0	0	0	0	0	9	0	0
	IND	0	0	1	17	0	0	0	0	0	18	0	0
	NIPF	0	0	2	8	0	0	0	0	1	9	0	0
	Total:	0	0	4	38	0	0	0	0	1	41	0	0
Avoid Incorporating Woody Debris in Road Fill III.D.6	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
	FED	0	0	0	9	0	0	0	0	0	9	0	0
	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	1	9	0	0	0	0	0	10	0	0
	Total:	0	0	1	41	0	0	0	0	0	42	0	0
Overburden Placement III.D.8	DNRC	0	0	0	3	0	2	0	0	0	3	0	2
	FED	0	0	0	6	0	3	0	0	0	6	0	3
	IND	0	0	0	13	0	5	0	0	0	13	0	5
	NIPF	0	0	1	7	0	2	0	0	0	8	0	2
	Total:	0	0	1	29	0	12	0	0	0	30	0	12
Sediment From Borrow Pits III.D.9	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
	FED	0	0	0	2	0	7	0	0	0	2	0	7
	IND	0	0	0	5	0	13	0	0	0	5	0	13
	NIPF	0	0	0	3	0	7	0	0	0	3	0	7
	Total:	0	0	0	14	0	28	0	0	0	14	0	28

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
Minimize	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
Reconstruction	FED	0	0	0	8	0	1	0	0	0	8	0	1
III.D.10	IND	0	0	0	13	0	5	0	0	0	13	0	5
	NIPF	0	0	0	7	0	3	0	0	0	7	0	3
	Total:	0	0	0	32	0	10	0	0	0	32	0	10
ROAD MAINTENANCE													
Grade Roads	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Drainage	FED	0	0	1	8	0	0	0	0	1	8	0	0
III.E.1	IND	0	0	2	16	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	3	39	0	0	0	0	1	41	0	0
Erosion Control	DNRC	0	1	0	4	0	0	0	1	0	4	0	0
Functional	FED	0	0	1	8	0	0	0	0	0	9	0	0
III.E.2	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	1	8	0	1	0	0	1	8	0	1
	Total:	0	1	2	38	0	1	0	1	1	39	0	1
Avoid Cutting	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
Slope Toe	FED	0	0	0	9	0	0	0	0	0	9	0	0
III.E.3	IND	0	0	1	16	0	1	0	0	0	17	0	1
	NIPF	0	0	1	8	0	1	0	0	1	8	0	1
	Total:	0	0	2	37	0	3	0	0	1	38	0	3
Restrict Use	DNRC	0	0	1	4	0	0	0	0	0	5	0	0
When Wet	FED	0	0	0	9	0	0	0	0	0	9	0	0
III.E.6	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	1	41	0	0	0	0	0	42	0	0
Adequate Drain.	DNRC	0	0	1	4	0	0	0	0	1	4	0	0
on Aband. Roads	FED	0	0	0	7	0	2	0	0	0	7	0	2
III.E.8	IND	0	0	0	3	0	15	0	0	0	3	0	15
	NIPF	0	0	0	5	1	4	0	0	0	6	0	5
	Total:	0	0	1	19	1	21	0	0	1	20	0	21

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
HARVEST DESIGN													
Logging Suits	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Topography	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.A.2	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0
Skid Trail	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Design	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.A.5	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0
Landing Size	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Location	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.A.6	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0
OTHER HARVEST ACTIVITY													
Skid to Min.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Displacing Soil	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.B.1a	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0
Skid to Min.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Compacting Soil	FED	0	0	0	8	0	1	0	0	0	8	0	1
IV.B.1b	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	41	0	1	0	0	0	41	0	1
Adequate Drain.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Landings	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.B.4	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

		APPLICATION						EFFECTIVENESS					
Practice	Owner	1	2	3	4	5	NR	1	2	3	4	5	NR
Adequate Drain.	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Skid Trails	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.B.5	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	1	9	0	0	0	0	0	10	0	0
	Total:	0	0	1	41	0	0	0	0	0	42	0	0
SITE PREPARATION													
Brush Blades	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
Used	FED	0	0	0	9	0	0	0	0	0	9	0	0
IV.C.2	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	41	0	1	0	0	0	41	0	1
Scarify Only	DNRC	0	0	0	4	0	1	0	0	0	4	0	1
to Extent	FED	0	0	0	9	0	0	0	0	0	9	0	0
Necessary	IND	0	0	0	18	0	0	0	0	0	18	0	0
IV.C.4	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	41	0	1	0	0	0	41	0	1
Compaction and	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Displacement	FED	0	0	0	9	0	0	0	0	0	9	0	0
Minimized	IND	0	0	1	17	0	0	0	0	1	17	0	0
IV.C.5	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	1	41	0	0	0	0	1	41	0	0
Equipment	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Operation	FED	0	0	0	9	0	0	0	0	0	9	0	0
On Suitable	IND	0	0	0	18	0	0	0	0	0	18	0	0
Slopes Only	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
IV.C.6	Total:	0	0	0	42	0	0	0	0	0	42	0	0
Limit WQ Impact	DNRC	0	0	2	3	0	0	0	0	0	5	0	0
of Fire	FED	0	-0	0	5	0	4	0	0	0	5	0	4
IV.C.8	IND	0	0	0	16	0	2	0	0	0	16	0	2
	NIPF	0	0	1	9	0	0	0	0	1	9	0	0
	Total:	0	0	3	33	0	6	0	0	1	35	0	6

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
STREAM CROSSINGS													
Proper Permit	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Obtained	FED	0	0	0	7	0	2	0	0	0	7	0	2
V.A.1	IND	0	0	0	11	0	7	0	0	0	11	0	7
	NIPF	0	0	0	9	0	1	0	0	0	9	0	1
	Total:	0	0	0	32	0	10	0	0	0	32	0	10
STREAM XING DESIGN													
Cross Stream	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
at Right Angle	FED	0	0	0	6	0	3	0	0	0	6	0	3
V.B.1a	IND	0	0	0	14	0	4	0	0	0	14	0	4
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	35	0	7	0	0	0	35	0	7
Direct Drainage	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Away From	FED	0	0	2	5	0	2	0	0	1	6	0	2
Stream Crossing	IND	0	0	0	14	1	3	0	0	0	15	0	3
V.B.2	NIPF	0	1	6	3	0	0	0	4	1	5	0	0
	Total:	0	1	8	27	1	5	0	4	2	31	0	5
Avoid Unimproved	DNRC	0	0	0	5	0	0	0	0	0	3	2	0
Crossings	FED	0	0	0	6	0	3	0	0	0	5	1	3
V.B.2	IND	0	0	0	14	0	4	0	0	0	14	0	4
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	35	0	7	0	0	0	32	3	7
STREAM XING INSTALLATION													
Min. Channel	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Disturbance	FED	0	0	0	7	0	2	0	0	0	7	0	2
V.C.1	IND	0	0	0	14	0	4	0	0	0	14	0	4
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	36	0	6	0	0	0	36	0	6
Culverts Conform	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
to Streambed	FED	0	0	0	5	0	4	0	0	0	4	1	4
Slope	IND	0	0	2	12	0	4	0	1	1	12	0	4
V.C.2	NIPF	0	0	0	9	0	1	0	0	0	9	0	1
	Total:	0	0	2	31	0	9	0	1	1	30	1	9

2000 BMP RATINGS BY PRACTICE AND OWNERSHIP GROUP

Practice	Owner	APPLICATION 1	2	3	4	5	NR	EFFECTIVENESS 1	2	3	4	5	NR
Proper Sizing	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
For Crossing	FED	0	0	0	6	0	3	0	0	0	6	0	3
Structures	IND	0	0	1	12	1	4	0	0	1	13	0	4
V.C.3	NIPF	0	0	1	9	0	0	0	0	0	10	0	0
	Total:	0	0	2	32	1	7	0	0	1	34	0	7
Prevent Fill	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
Erosion	FED	0	0	1	5	0	3	0	0	0	6	0	3
V.C.4	IND	0	0	0	14	0	4	0	0	0	14	0	4
	NIPF	0	1	0	8	0	1	0	1	0	8	0	1
	Total:	0	1	1	32	0	8	0	1	0	33	0	8
Adequate Cover	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
for Culverts	FED	0	0	0	4	0	5	0	0	0	4	0	5
V.C.6	IND	0	0	0	14	0	4	0	0	0	14	0	4
	NIPF	0	0	0	9	0	1	0	0	0	9	0	1
	Total:	0	0	0	32	0	10	0	0	0	32	0	10
HAZARDOUS SUBSTANCES													
Proper Storage	DNRC	0	0	0	5	0	0	0	0	0	5	0	0
and Disposal	FED	0	0	0	9	0	0	0	0	0	9	0	0
VII.1	IND	0	0	0	18	0	0	0	0	0	18	0	0
	NIPF	0	0	0	10	0	0	0	0	0	10	0	0
	Total:	0	0	0	42	0	0	0	0	0	42	0	0
GRAND	TOTALS:	0	5	57	1667	5	198	0	12	30	1689	3	198

APPENDIX J

SUMMARY OF 2000 AUDIT DEPARTURES AND IMPACTS BY BMP

BMP Sec	BMP Sub	BMP	APP 2	APP 3	APP Tot	EFF 2	EFF 3	EFF Tot	Grand Tot
* III	C	1		12	12	1	8	9	21
V	B	1B	1	8	9	4	2	6	15
* III	C	6	1	4	5	2	4	6	11
III	C	2		5	5		2	2	7
III	D	5		4	4		1	1	5
* III	E	2	1	2	3	1	1	2	5
III	C	4		2	2		2	2	4
* III	D	2		1	1		3	3	4
III	E	1		3	3	1		1	4
* IV	C	8		3	3		1	1	4
V	C	2		2	2	1	1	2	4
III	E	3		2	2		1	1	3
V	C	3		2	2		1	1	3
* V	C	4	1	1	2	1		1	3
III	D	3	1		1	1		1	2
III	E	8		1	1		1	1	2
* IV	B	5		1	1		1	1	2
IV	C	5		1	1		1	1	2
III	D	6		1	1				1
III	D	8		1	1				1
III	E	6		1	1				1
			5	**57**	**62**	**12**	**30**	**42**	**104**

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